Fishery Data Series No. 10-66

Tatlawiksuk River Salmon Studies, 2009

Final Report for Study 07-304
USFWS Office of Subsistence Management
Fisheries Resource Monitoring Program

by

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and

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October 2010

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	\$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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October 2010

Development and publication of this manuscript was partially financed by the USFWS Office of Subsistence Management (Project 07-304) Fisheries Resource Monitoring Program under Agreement 701817J647. Matching funds were provided by Coastal Villages Region Fund and the State of Alaska.

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This document should be cited as:
Smith, M. L., and C. A. Shelden. 2010. Tatlawiksuk River salmon studies, 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-66, Anchorage.

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ABSTRACT

The Tatlawiksuk River is a major tributary of the Kuskokwim River and produces Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, and coho salmon *O. kisutch* which contribute to subsistence and commercial salmon fisheries of the Kuskokwim River. The Tatlawiksuk River weir has operated since 1998 to estimate the return and age-sex-length compositions of salmon escapements, monitor environmental variables, and facilitate other Kuskokwim Area fisheries projects. In 2009, a resistance board weir was operated from 15 June to 22 September to estimate escapements of 3 species of Pacific salmon. Chinook escapement (1,071) was below average, chum escapement (19,975) was near average, and coho escapement (10,155) was above average. Samples were collected from fish caught in a live trap and used to describe the age and sex structure of the Chinook, chum, and coho salmon escapements. Females comprised 45.0% of the Chinook salmon escapement, 51.9% of the chum salmon escapement, and 47.8% of the coho salmon escapement. The Chinook salmon escapement was composed of 4 age classes, dominated by age-1.4 fish (46.6%). The chum salmon escapement was composed of 4 age classes, dominated by age-0.3 fish (64.4%). The coho salmon escapement was composed of 3 age classes, dominated by age-2.1 fish (83.9%).

The Tatlawiksuk River weir is one of several components which form an integrated array of escapement monitoring projects in the Kuskokwim Area. This array of projects provides a means to monitor and assess escapement trends that must be considered in harvest management.

Key words Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, longnose suckers, *Catostomus catostomus*, escapement, age-sex-length, ASL, Tatlawiksuk River, Kuskokwim River, resistance board weir, radiotelemetry, mark–recapture, stock specific run timing, upper Kuskokwim

INTRODUCTION

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2, or 11% of the total area of Alaska (Figure 1). Each year mature salmon *Oncorhynchus* spp. return to the river to spawn, supporting an annual average subsistence and commercial harvest of nearly 1 million salmon. The subsistence salmon fishery in the Kuskokwim Area is one of the largest and most important in the state and remains a fundamental component of local culture. The commercial salmon fishery, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower Kuskokwim River communities. Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin (Brown 1983; Buklis 1999; Coffing 1991; Coffing et al. 2001; Whitmore et al. 2008).

Since 1960, management of Kuskokwim River subsistence, commercial, and sport fisheries has been the responsibility of the Alaska Department of Fish and Game (ADF&G), though other agencies contribute to the decision making process. Management authority for the subsistence fishery was broadened in October 1999 to include the federal government under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). The U.S. Fish and Wildlife Service (USFWS) is the federal agency most involved within the Kuskokwim Area and tribal groups such as the Kuskokwim Native Association (KNA) are charged by their constituency to actively promote a healthy and sustainable subsistence salmon fishery. These and other groups have combined their resources to develop projects such as the Tatlawiksuk River weir to better achieve the common goal of providing for sustainable salmon fisheries in the Kuskokwim River.

In the State of Alaska, the goal of salmon management is to provide for sustainable fisheries by ensuring that adequate numbers of salmon escape to the spawning grounds each year in accordance with the State of Alaska's Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222). This goal requires an array of long-term monitoring projects that reliably measure annual escapement to key spawning systems as well as track temporal and spatial patterns in abundance that influence management decisions. Over time and with sufficient data, escapement goals can be developed as a means to gauge escapement adequacy, but current spawner–recruit models for escapement goal development require many years of data. For much of ADF&G management history in the Kuskokwim Area, escapement monitoring has been limited to aerial surveys and 2 ground-based escapement monitoring projects.

With dozens of tributaries known to support spawning populations of salmon, the presence of escapement monitoring projects on 2 tributaries was not adequate with respect to the entire Kuskokwim River basin. This deficiency was addressed with the establishment of several additional projects in the mid to late 1990s, including the Tatlawiksuk River weir in 1998 (Molyneaux and Brannian 2006). The data provided by the current array of projects have much greater utility for fishery managers (Holmes and Burtkett 1996; Mundy 1998) and have decreased reliance on aerial stream surveys, which are known to be imprecise (Whitmore et al. 2008). In addition, mainriver tagging studies rely on the expanded weir infrastructure to estimate inriver abundance and develop run reconstruction models for Kuskokwim River salmon. Run reconstruction models that result from these studies will be an important tool in answering questions of exploitation, distribution, abundance and travel time for Kuskokwim River salmon and may eventually lead to the development of escapement goals for the entire Kuskokwim River drainage. Such projects have since become deeply integrated components of Kuskokwim River salmon management.

The Tatlawiksuk River weir also serves as a platform for collecting information on habitat variables including water temperature and stream discharge (stage), which may directly or indirectly influence salmon productivity and timing of migrations (Hauer and Hill 1996; Kruse 1998; Quinn 2005). These variables can be affected by human activities (i.e., mining, timber harvesting, man-made impoundments, etc.; NRC 1996) or broader climatic variability (e.g., El Nino and La Nina events).

BACKGROUND

The Tatlawiksuk River is a tributary of the middle Kuskokwim River basin that provides spawning and rearing habitat for Chinook (*O. tshawytscha)*, chum (*O. keta)*, and coho salmon (*O. kisutch)* (ADF&G 1998) and has a history of subsistence use. According to Elders of nearby communities, Athabaskan groups routinely harvested salmon from the Tatlawiksuk River until the mid-1900s (Andrew Gusty Sr., Resident, Stony River village; personal communication). Periodically during the last 40 years ADF&G biologists have observed salmon escapements in the mainstem Tatlawiksuk River during aerial surveys (Burkey and Salomone 1999; D. J. Schneiderhan, Kuskokwim stream catalog, 1954–1983, Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage).

Salmon escapement monitoring began at the Tatlawiksuk River in 1998 through the joint effort of KNA and ADF&G (Linderman et al. 2002). Operations in 1998 were incomplete and the fixed-panel weir design was replaced with a resistance board weir in 1999, which improved performance in subsequent years. Since then, the Tatlawiksuk River weir has been collecting escapement and age, sex, length (ASL) composition information on Chinook, chum, and coho salmon; habitat and climatic variables; and has served as a platform for other collaborative research efforts (Stewart et al. 2008).

Tatlawiksuk River originates in the foothills of the Alaska Range and flows southwesterly for 113 km, draining an area of approximately 2,106 km^2 before joining the Kuskokwim River at river kilometer (rkm) 553 (Figure 1). Throughout most of the river's course, it meanders across wide, flat valleys vegetated with white spruce and scattered birch or aspen. Black spruce is more characteristic in poorly drained areas of the basin and dense stands of willow and alder occur on sand and gravel bars. Unnamed streams that join the Tatlawiksuk River from the southeast and northeast drain extensive bog flats and swampy lowlands in the lower reaches of the basin. The channel gradient of the lower 80 km is approximately 1.5 m per km (Brown 1983).

OBJECTIVES

1. Determine daily and total Chinook, chum, and coho salmon escapements to Tatlawiksuk River from 15 June to 20 September.
2. Estimate the age, sex, and length composition of Chinook, chum, and coho salmon escapements to the Tatlawiksuk River such that 95% confidence intervals of age composition are no wider than ±10% (α=0.05 and d=0.10).
3. Monitor habitat variables including daily water temperature, water level, and stream discharge.
4. Provide mentorship and administer education curriculum to KNA high school interns.
5. Serve as a platform to facilitate current and future fisheries research projects by:
    a. Serving as a monitoring and recovery location for coho salmon equipped with radio transmitters and anchor tags deployed as part of *Kuskokwim River Coho Salmon Investigations;*
    b. Installing and monitoring air and stream thermographs at Tatlawiksuk River weir as part of a broader *Temperature Monitoring* project.; and
    c. Serving as a collection location for longnose sucker (*Catostomus catostomus)* tissue samples for genetic analysis.

METHODS

STUDY SITE

In 2009, the Tatlawiksuk River weir site was located approximately 4.5 rkm upstream from the confluence with the mainstem Kuskokwim River, and 557 rkm from the mouth of the Kuskokwim River (Figure 1), the same site that has been utilized for the past 11 years. Salmon spawning in the Tatlawiksuk River downstream of the weir site was assumed to be negligible due to historic observations. At the weir site, the river measured 64 m wide and 1 m deep during normal summer operations. The weir was positioned in the center of a wide bend, adjacent to a high cut bank to the east and a small floodplain to the west. Dense patches of alder and willow suggest that the floodplain was at an intermediate stage of succession and terracing of the floodplain indicated that the stream channel has shifted course many times. The floodplain was interspersed with small channels that remained isolated except in periods of extreme high water.

WEIR DESIGN

Details of design and materials used to construct the resistance board weir are described in Tobin (1994) with panel modifications described by Stewart (2002). The Tatlawiksuk River weir was designed with a gap of 3.33 cm (1-5/16 in) between each picket. The weir was installed across the entire 64 m channel following the techniques described by Stewart (2003). The substrate rail and resistance board panels covered the middle 58 m portion of the channel, and fixed weir materials extended the weir 3 m to each bank.

A live trap and skiff gate were installed within the deeper portion of the channel. The live trap was designed as the primary means of upstream fish passage. The trap could be easily configured to pass fish freely upstream, capture individual fish for tag recovery, or trap numerous fish for collection of ASL or genetic samples. The skiff gate allowed boat operators to pass with little or no involvement of the weir crew as the weight of a boat submerged the passage panels and allowed boats to pass over the weir. Boats with jet-drive engines were the most common and could pass up or downstream over the skiff gate after reducing speed to 5 miles per hour or less.

To accommodate downstream migration of longnose suckers and other non-salmon species, downstream passage chutes were installed into the weir mid-season. At locations where downstream migrants were most concentrated, chutes were created by releasing the resistance boards on 1 or 2 adjacent weir panels so the distal ends dipped slightly below the stream surface. The chute's shallow profile guides downstream migrants while preventing upstream salmon passage. The chutes were monitored and adjusted to ensure salmon were not passing upstream. Few salmon have been observed passing downstream over these chutes, and their numbers are considered negligible.

Escapement Monitoring

A target operational period, spanning most of the salmon runs, was used to provide for consistent comparisons of annual escapements among years. The target operational period for Tatlawiksuk River weir has been established as 15 June to 20 September, although actual operational dates may vary annually with stream conditions. Daily and total annual escapements consisted of the observed passage during the target operational period. Counts of all other species were reported simply as total observed passage.

Passage counts were conducted periodically during daylight hours. Substantial delays in fish passage occurred only at night or during ASL sampling. Crew members visually identified each fish as it passed upstream and recorded it by species on a multiple tally counter. Counting continued for a minimum of 1 hour, or until passage waned. This schedule was adjusted as needed to accommodate the migratory behavior and abundance of fish, or operational constraints such as reduced visibility in evening hours late in the season. Crew members recorded the total upstream fish count in a designated notebook and zeroed the tally counter after each counting session. At the end of each day, total daily and cumulative seasonal counts were copied to logbook forms. These counts were reported each morning to ADF&G staff in Bethel via single side band radio or satellite telephone.

The live trap was used as the primary means of upstream fish passage. A clear plastic viewing window was placed on the stream surface to improve visual identification of fish entering the trap. A secondary passage gate described in Costello et al. (2007) was employed during extreme low water conditions when fish showed reluctance to pass through the live trap.

Age, Sex, and Length Composition

To estimate age, sex, and length composition of Chinook, chum, and coho salmon escapements, live sampling was conducted as fish migrated upstream through the weir. Samples were collected throughout the season to account for temporal dynamics in ASL characteristics. Samples were stratified postseason to develop weighted estimates.

Sample Size and Distribution

A minimum sample size was determined for each species following conventions described by Bromaghin (1993) to achieve 95% confidence intervals of age-sex composition no wider than ±10% (α=0.05 and d=0.10), assuming 10 age-sex categories for Chinook salmon (n=190), 8 age-sex categories for chum salmon (n=180), and 6 age-sex categories for coho salmon (n=168). These sample sizes were then increased by about 20% to account for unreadable scales or collection errors. This yielded a minimum collection goal for each sample of 230 Chinook, 220 chum, and 200 coho salmon.

The abundance of chum and coho salmon at Tatlawiksuk River weir was generally high enough to collect a large sample size in a short period of time. A pulse sampling strategy was employed to ensure adequate temporal distribution of chum and coho salmon samples. A pulse sample is essentially random stratified sampling, where each instantaneous sample characterizes a large portion of the run (i.e., early, middle, and late). Well spaced pulse samples are thought to have greater power for detecting temporal changes in ASL composition than other sampling methods (Geiger and Wilbur 1990). Pulse sampling was conducted approximately every 7–10 days. The goal was to collect a minimum of one pulse sample from each third of the run.

The relatively low abundance of Chinook salmon at Tatlawiksuk River weir makes pulse sampling impractical. Instead, the sample was collected continuously over the run following a daily collection schedule based on historical run timing information. Daily sample sizes were proportional to average historical escapements by day to ensure a good distribution across the run. The overall sample size was selected to exceed the minimum necessary to meet precision and accuracy criteria for this location and was similar to average historical sampling success.

Sample Collection Procedures

Salmon were sampled from the fish trap installed in the weir. Salmon were trapped by opening the entrance gate while the exit gate remained closed. Fish were allowed to swim freely into the live trap, and the V-shape positioning of the entrance gate prevented them from easily escaping. The live trap was allowed to fill with fish until a reasonable number was inside. Short handled dip nets were used to capture fish within the holding box. To obtain length data and aid in scale collection, fish were removed from the dip net and placed into a partially submerged fish "cradle." Scales were taken from the preferred area of the fish (INPFC 1963) and transferred to numbered gum cards (DuBois and Molyneaux 2000). Sex was determined through visual examination of the external morphology, focusing on the prominence of a kype, roundness of the belly, and the presence or absence of an ovipositor. Mid-eye-fork (MEF) length was measured to the nearest millimeter using a straight-edged meter stick. Sex and length data were recorded on standardized numbered data sheets that correspond with numbers on the gum cards used for scale preservation. After sampling, each fish was released upstream of the weir. The procedure was repeated until the holding box was emptied, to ensure no bias was introduced.

Chinook salmon samples were often collected through "active sampling," which consisted of capturing and individually sampling while actively passing and counting all salmon. To prevent bias, active sampling was conducted on each Chinook salmon individual observed during the sampling/passing procedure. Further details of the active sampling procedures are described in Linderman et al. (2002). This method was also used for tag recoveries.

After sampling was completed, relevant information such as sex, length, sampling date, and sampling location was copied to computer mark–sense forms that correspond to numbered gum cards. The completed gum cards and mark–sense forms were sent to the Bethel and/or Anchorage ADF&G offices for processing. The original ASL gum cards, acetates, and mark–sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices. Data were also loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2006). Further details of sampling procedures can be found in Molyneaux et al. (2008).

Data Processing and Reporting

Samples were aged and processed by ADF&G staff in Bethel and Anchorage following procedures describe by Molyneaux et al. (2008). Samples were partitioned into a minimum of 3 temporal strata, based on overall distribution within the run. The escapement in each stratum was divided into age-sex classes proportionately with strata sample composition. Mean length by age-sex class was determined for each stratum as well. Annual estimates were calculated as strata sums, weighted by the abundance in each stratum. When sample size or distribution was not considered adequate to estimate ASL composition, results were reported but not applied to annual escapements.

Two summary tables were generated for each species. The first table provides the escapement and percentage of each age-sex class by stratum, with season totals weighted by escapement in each stratum. The second table provides a summary of mean length-at-age by sex for each stratum, with season totals weighted by escapement in each stratum. Sample sizes and dates are included for each stratum. Age is reported in the European notation, composed of 2 numerals separated by a decimal. The first numeral represents the number of winters the juvenile spent in freshwater excluding the first winter spent incubating in the gravel, and the second numeral is the number of winters it spent in the ocean (Groot and Margolis 1991). The total age is therefore one year greater than the sum of these 2 numerals.

WEATHER AND STREAM OBSERVATION

Water and air temperatures were manually measured each day in °C at approximately 10:00 and 17:00 hours. Water temperature was determined by submerging a calibrated thermometer below the water surface until the temperature reading stabilized. Air temperature was obtained by placing the thermometer in a shaded location until the temperature reading stabilized. Temperature readings were recorded in the logbook, along with notations about cloud cover, wind direction, wind speed, and precipitation. Wind speed was estimated to the nearest 5 miles per hour, and daily precipitation was measured (in millimeters) using a rain gauge (Appendix A).

Water level observations represented the stream height in centimeters above an arbitrary datum plane. Water levels were measured using a staff gage installed about 150 meters downstream from the weir. The staff gage, which is installed annually, was calibrated using a sight level to a reliable benchmark installed in 2005 (Costello et al. 2006), which replaced semi-permanent benchmarks installed in previous years (Stewart and Molyneaux 2005; Appendix A).

KUSKOKWIM NATIVE ASSOCIATION HIGH SCHOOL INTERNSHIP PROGRAM

Local area high school students were recruited to participate in the Kuskokwim Native Association's (KNA) High School Internship Program at the Tatlawiksuk River weir for 3 weeks. Students spent 1 or 2 weeks at the weir site completing a daily educational curriculum and participating in weir duties. The program included a hands-on fisheries science curriculum featuring examples from current Kuskokwim Research Projects. Crew members instructed students in fish species identification, weather and stream observations, and ASL sampling. In addition, the crew assisted Carolyn Hackett, KNA Partners Fisheries Educator, in conducting daily lessons related to salmon biology and watershed ecology and accompanying field activities. All interns were expected to complete daily assignments and a final project to demonstrate their understanding of the fisheries and environmental monitoring techniques presented in the program. Career guidance and mentoring from practicing fisheries biologists and technicians is an integral part of the program and provides students with role models for future work in fisheries science.

RELATED FISHERIES PROJECTS

Kuskokwim River Coho Salmon Investigations

The Tatlawiksuk River weir served as a recovery site for a basinwide mark–recapture and radiotelemetry study entitled *Kuskokwim River Coho Salmon Investigations*, funded by the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative. Upstream passage of all fishes occurred through the weir's live trap, enabling captures of tagged coho salmon. A clear plastic viewing window on the stream surface aided species identification and tag presence. Recorded data for 'recovered' fish included the tag number, tag color, fish condition, presence of secondary mark, and recovery date. Tagged fish that passed through the trap without being captured were recorded as "observed" along with the tag color and passage date. Tag loss was assessed at the weir by inspecting for secondary marks during routine ASL sampling.

Longnose Sucker Tissue Sampling

Dorsal fin clips were collected opportunistically from mature longnose suckers in support of a genetic stock identification study. Sampling occurred during regular ASL sampling events when longnose suckers were trapped, or when living individuals were found on the weir. A portion of the dorsal fin approximately 13 mm long and 6.5 mm wide was clipped from 30 longnose suckers and stored separately in vials containing Ethanol. Sex and total length were also determined for each individual. Sample vials and data sheets were mailed to University of Michigan (Peter McIntyre, Principle Investigator, University of Michigan School of Natural Resources & Environment).

Temperature Monitoring

Tatlawiksuk River weir also served as a monitoring site for the *Temperature Monitoring* project funded by Office of Subsistence Management, Fishery Resource Monitoring Program (FRMP 08-701). Two Hobo® Water Temp Pro V2 data loggers and two Hobo® Air Temperature R/H data loggers were deployed on 15 June and removed and/or downloaded on 20 September. The water temperature loggers were anchored to the bottom near mid-channel and the air temperature loggers were installed using a solar shield attached to a pole. At the end of the field season, 1 water and 1 air temperature logger were removed and returned to the contractor, while the other 2 were kept for continual monitoring of the site.

RESULTS

OPERATIONS

Tatlawiksuk River weir operated from 20:30 hours on 14 June until nightfall on 22 September, spanning the entire target operational period. Weir integrity was maintained for the entire operational period; therefore passage counts are assumed to represent a complete census of target species.

Chinook and chum salmon were reported by the weir crew to be spawning in low numbers below the weir. Approximately 15 Chinook and 50 chum salmon redds were observed by the Tatlawiksuk crew in a riffle about 2.4 km below the weir site. This behavior has not been documented previously, but historic low water levels may have increased visibility in the water column more than previous project years.

ESCAPEMENT ABUNDANCE AND RUN TIMING

Chinook Salmon

A total of 1,071 Chinook salmon were observed passing upstream of the weir during the operational period. The first Chinook salmon was seen on 21 June, and a peak count of 186 fish occurred on 5 July. The central 50% of the run occurred from 7 to 13 July, with a median passage date of 9 July (Table 1; Figure 2).

Chum Salmon

A total of 19,975 chum salmon were observed passing upstream of the weir during the operational period. The first chum salmon passed the weir on 16 June, and a peak count of 1,175 fish occurred on 19 July. The central 50% of the run occurred from 9 to 21 July, with a median passage date of 15 July (Table 1; Figure 2).

Coho Salmon

A total of 10,148 coho salmon were observed passing upstream of the weir during the operational period. The first coho salmon was observed on 24 July, and a peak count of 1,539 fish occurred on 17 August. The central 50% of the run occurred from 17 to 28 August, with a median passage date of 19 August. An additional 7 coho salmon were counted after the end of the target operational period, 21 and 22 September (Table 1; Figure 2).

Other Species

A total of 39 sockeye salmon and 3 pink salmon were observed passing upstream of the weir during the operational period. Non-salmon species included 2,042 longnose suckers, 6 whitefish (*Coregonus* spp.), 16 Arctic grayling (*Thymallus arcticus*), 10 northern pike (*Esox lucius*), and 1 Dolly Varden (*Salvelinus malma*) (Table 1).

Carcasses

Salmon carcass counts included 11 Chinook, 593 chum, and 32 coho salmon (Appendix B). Females accounted for 9%, 32%, and 34% of the Chinook, chum, and coho salmon carcasses respectively. The first Chinook salmon carcass was found on 4 August. The first chum salmon carcass was found on 8 June, and a peak count of 46 occurred on 7 August. The first coho salmon carcass was observed on 31 June.

Age, Sex, and Length Composition

Chinook Salmon

ASL samples were collected from 113 Chinook salmon from 30 June to 9 August. Age was determined for 93 of these samples (82% of the total sample), or 9% of the Chinook salmon escapement. Due to small sample size and poor distribution over the run, ASL samples were inadequate to estimate age and sex composition. To reduce the consequence of skewed sampling distribution on ASL estimates, the escapement was partitioned into 2 temporal strata based on sampling dates and run timing. Stratum one encompassed the first 93% of the run with 42 samples, and stratum two encompassed the last 7% of the run with 51 samples (Table 2).

Age composition of scale samples included 16 age-1.2 fish, 24 age-1.3 fish, 52 age-1.4 fish and 1 age-2.4 fish. Sex composition included 38 males, and 55 females. The lengths of male Chinook salmon ranged from 486 to 793 mm and females ranged from 546 to 965 mm (Table 3).

Chum Salmon

ASL samples were collected from 923 chum salmon from 8 July to 4 August. Age was determined for 829 of these samples (90% of the total sample), or 4% of the escapement. ASL samples were adequate to estimate age and sex composition of the total chum salmon escapement. Escapement was partitioned into 3 temporal strata based on sampling effort over the run, with sample sizes of 223, 207, and 399 fish per consecutive strata. Age-0.3 chum salmon were the most abundant (64.4%), followed by age-0.4 (23.9%), age-0.2 (7.8%) and age-0.5 (3.8%). Sample size and distribution resulted in 95% confidence intervals that ranged from ±1.5% to ±3.5%. Sex composition included 48.1% male and 51.9% female (Table 4). The lengths of males ranged from 438 to 643 mm and females ranged from 430 to 627 mm (Table 5).

Coho Salmon

ASL samples were collected from 615 coho salmon from 12 August to 5 September. Age was determined for 508 of these samples (83% of the total sample), or 5% of the escapement. ASL samples were adequate to estimate age and sex composition of the total coho salmon escapement. Escapement was partitioned into 3 temporal strata based on sampling effort over the run, with samples sizes of 169, 165, and 174 fish per strata. Age-2.1 coho salmon were the most abundant (83.9%), followed by age-3.1 (9.8%) and age-1.1 (6.3%). Sample size and distribution resulted in 95% confidence intervals for age sex compositions that ranged from ±2.2% to ±3.3%. Sex composition included 52.2% male and 47.8% female (Table 6). The lengths of males ranged from 369 to 636 mm and females ranged from 380 to 623 mm (Table 7).

Weather and Stream Observation

During the operation period, water level ranged from 7 to 42 cm and averaged 17 cm. Stream temperature ranged from 3.0 to 15.0°C and averaged 9.9°C (Appendix A). Stream discharge was measured once on 23 July, showing an average flow of 0.73 m/sec at an average depth of 43.56 cm (Figure 3).

KNA High School Internship Program

A total of 5 students participated in the KNA High School Internship Program, including 3 first-year and 2 second-year interns.

Related Fisheries Projects

Kuskokwim River Coho Salmon Investigations

The fixed receiver stationed on the bank adjacent to the weir recorded 4 radiotagged coho salmon that passed upstream of the weir site unrecovered. One additional anchor tagged coho salmon was recovered at the weir.

Longnose Sucker Tissue Sampling

Dorsal fin tissue samples were collected from 30 mature longnose suckers.

Temperature Monitoring

Results for temperature monitoring will be reported under USFWS, Office of Subsistence Management, Project No. 08-701.

DISCUSSION

Operations

Daily and season total escapements were successfully determined for all target species at the Tatlawiksuk River weir in 2009 (Table 1). Normal to low water contributed to successful weir operation throughout the season with no inoperable periods (Figure 4). ASL composition was estimated successfully for chum and coho salmon.

Chinook salmon ASL sampling was problematic due to a relatively low escapement and water levels throughout the season. Historic low water levels resulted in unusually high water clarity during the latter half of the Chinook salmon run. Due to these river conditions, fish were often hesitant to pass through the weir's live trap for long periods after sampling activity. Therefore, sampling was suspended on several occasions to allow unrestricted passage through the weir's live trap.

Project objectives were also met for KNA's High School Internship Program, weather and stream observations, and related fisheries projects.

Chinook Salmon

Chinook salmon escapement (1,071) was the third lowest on record in 2009 (Figure 5). The second lowest escapement on record occurred in 2008 (1,071). However 2007 experienced an escapement (2,059) that was above historical average.

Chinook salmon run timing fell within average historical range (Figure 2). However, passage of the central 50% of the run was 4 days shorter than historical average. The second latest median passage date on record occurred in 2008, with passage of the central 50% extending later than any other project year. In 2007, Chinook salmon run timing fell within average historical range.

Age-1.2, -1.3, and -1.4 Chinook salmon dominated ASL samples in all project years (Figure 6). In some project years, age-1.5 fish also contributed a small number of samples. Escapement estimates by age were above historical average for age-1.5 and -1.3 fish in 2007. However, escapement estimates were below historical average for all age classes in 2008. Season percent composition of female Chinook salmon reached a historic low (27%) in 2007, but increased to near historical average estimates the following year (Figure 7). Age-sex class structure was not determined for 2009 as described above.

CHUM SALMON

Chum salmon escapement (19,975) was the third lowest on record (Figure 5). Escapement was near historical average in 2008 (30,872); however the largest recorded escapement occurred in 2007 (83,250).

Based on median passage dates, the chum salmon run was the latest on record (Figure 2). Run timing estimates were also later than historical average in 2007 and 2008.

Age-0.3 chum salmon dominated ASL samples in most project years, followed by age 0.4 fish (Figure 6). This age proportion was observed in 2009 and 2007. However, 2008 age-0.4 fish returned in historic numbers and dominated the ASL samples. Season percent composition of females was above historical average from 2007 to 2009, remaining 52% in all three years (Figure 7).

COHO SALMON

Coho salmon escapement (10,148) was near historical average (Figure 5). Escapements in 2008 and 2007 were also near historical average.

Based on median passage dates, the coho salmon run was 3 days earlier than the historical average (Figure 2). Run timing estimates were also earlier than historical average in the 2 previous project years, with 2007 being the earliest run on record.

Age-2.1 coho salmon dominated ASL samples in all project years (Figure 6). Season percent composition of female coho salmon reached a historic peak in 2008 and 2009 (Figure 7). High water precluded sex composition estimates in 2007.

OTHER SPECIES

The Tatlawiksuk River is not a primary spawning tributary for sockeye and pink salmon. Accurate enumeration of spawning pink salmon at the weirs is confounded by their small size, which allows some individuals to pass between pickets undetected. Furthermore, it is unclear to what extent either of these species represent a distinct Tatlawiksuk River spawning population or strays from nearby tributaries.

Longnose suckers are historically the most abundant non-salmon species, and Tatlawiksuk River is thought to have a distinct breeding population. As many as 5,093 longnose suckers have been observed migrating upstream of the weir. However, enumeration of longnose suckers is incomplete because smaller individuals may be able to pass freely between pickets and upstream migration appears to start before weir operations typically begin. Counts of all resident fishes were not unusual.

CARCASS COUNTS

The number of salmon carcasses found on the weir is not a complete census of the number of post-spawning salmon (postspawners) above the weir site (Appendix B). The "sucker chutes" that are installed to facilitate downstream passage of non-salmon species provide a pathway for post-spawners or weak salmon to drift downstream. Daily carcass counts noticeably decrease following chute installation, and no attempt was made to estimate missed carcasses. Additionally, the weir was removed long before most coho salmon had completed spawning, so the number of coho salmon carcasses counted on the weir largely underestimates the number of post-spawners that drifted past the weir site.

WEATHER AND STREAM OBSERVATION

Water temperature was near historical average for much of the operational period at Tatlawiksuk in 2009, with a few extreme periods (Figure 4). Higher water levels early in the season coincided with higher than average water temperatures. A combination of high air temperatures and low precipitation in early July coincided with historically low water levels and high water clarity. Water level continued to be low for the remainder of the season, but water temperature resembled historical average data.

KNA HIGH SCHOOL INTERNSHIP PROGRAM

Since 1998, KNA has provided 184 internships to local area high school students at fisheries projects operated cooperatively with ADF&G. A number of students have subsequently been employed by KNA and ADF&G as technicians at these same projects (Hildebrand and Orabutt 2007). KNA internships benefit both students and the projects that host them. Interns gain exposure to fisheries monitoring projects and the employment opportunities associated with them. The projects gain a much needed level of community involvement, which the authors believe contributes to continued local support of the research and management utility of the weirs. *Tatlawiksuk River Salmon Studies* (07-304) has provided half of the funding for KNA's High School Internship Program for all 3 project years. In 2007, several KNA high school interns also participated in a Chinook salmon tagging project at the ADF&G fish wheels near Kalskag.

RELATED FISHERIES PROJECTS

In 2009, the Tatlawiksuk River weir successfully served as a monitoring location for *Kuskokwim River Coho Salmon Investigations*, and *Temperature Monitoring*.

CONCLUSIONS

2007 Escapement monitoring occurred from 13 June to 16 September, with an inoperable period from 6 August to 11 August due to high water.

Daily and total annual escapements were successfully determined all objective species.

ASL compositions were successfully determined for Chinook, and chum salmon; however estimates were precluded for coho salmon (Figure 8, 9, and 10).

Project objectives were successfully met for Weather and Stream Observations, KNA High School Internship Program, *Kuskokwim River Chinook Salmon Run Reconstruction*, and *Kuskokwim River Sockeye Salmon Investigations*.

2008 Escapement monitoring occurred from 15 June to 18 September, with an inoperable period from 29 June to 7 July due to high water.

Daily and total annual escapements were successfully determined for all objective species.

ASL compositions were successfully determined for all objective species (Figure 8, 9, and 10).

Project objectives were successfully met for Weather and Stream Observations, KNA High School Internship Program, *Temperature Monitoring*, *Kuskokwim River Coho Salmon Investigations*, and *Investigation of Stable Isotope and Otolith Elemental Analyses as Tools for Salmon Stock Assessment*.

2009 Escapement monitoring occurred from 14 June to 22 September.

Daily and total annual escapements were successfully determined for all objective species.

ASL compositions were successfully determined for all objective species (Figure 8, 9, and 10).

Project objectives were successfully met for Weather and Stream Observations, KNA High School Internship Program, *Temperature Monitoring*, and *Kuskokwim River Coho Salmon Investigations*.

RECOMMENDATIONS

1. Continue operation of Tatlawiksuk River weir during the established operational period indefinitely.
2. The Tatlawiksuk River weir should continue to operate as a cooperative project between KNA and ADF&G.
3. Continue to collect escapement data for contribution to run reconstructions and abundance estimates and to contribute to the possible establishment of escapement goals for Chinook, chum, and coho salmon.
4. Continue ASL data collection on all species indefinitely, in order to better understand spawner–recruit relationships.
5. Sampling breaks should be built into the season schedule, which are sufficient to facilitate passage in low water conditions without skewing sampling effort.
6. Continue daily weather and stream measurements manually and using the Hobo® Air and Water Temperature data loggers.

ACKNOWLEDGEMENTS

The Tatlawiksuk River weir project is operated cooperatively by KNA and ADF&G, Division of Commercial Fisheries. The USFWS, Office of Subsistence Management, provided $78,634 in 2009 for this project through the Fisheries Resource Monitoring Program (FRMP), under agreement numbers 701817J647 and 701817C298, with matching support from the State of Alaska and KNA. Additionally, FRMP helps fund salmon age, sex, and length data analysis for this and many other projects in the Kuskokwim Area under agreement number 701817J646, and provides a KNA biologist position through its Partners Program in support of this and other projects under agreement number 701812J479. Operational funds have been provided to KNA from a number of sources including grants from the National Fish and Wildlife Foundation, and grants from the U.S. Bureau of Indian Affairs administered by the Bering Sea Fishermen's

Association (BSFA). The Tatlawiksuk River weir was initiated under a grant from the Western Alaska Disaster Relief Program under the National Oceanic and Atmospheric Administration. Other groups such as the Kuskokwim Corporation and the ADF&G Division of Sport Fish have provided in-kind support to the project in the form of free land use for camp facilities, weir fabrication, and welding services. General Fund support from ADF&G included assistance from staff biologists, fish and wildlife technicians who serve as crew leaders or crew members, and some operational costs.

Many individuals contributed to the operation of the Tatlawiksuk River weir in 2009. Administrative and logistical support was provided by Douglas B. Molyneaux and Ashley Fairbanks of ADF&G; and Mike Thalhauser, and Seraphim Ukatish of KNA. Thanks also to KNA field personnel: Mike Sakar (technician); Rochelle Sakar and Alex Nicori (college interns); Wendy Parent, Brad Gusty, Francis Vaska, Fritz Guy, and Michael Epchook (high school interns); and Carrie Hackett (Internship Coordinator) for contributing to the successful project in 2009. We especially thank the Gregory family of Sinka's Landing for providing winter storage facilities and many hours of Alaskan hospitality.

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TABLES AND FIGURES

Table 1.–Daily and cumulative percent passage for all salmon and resident fish species at the Tatlawiksuk River weir, 2009.

	Chinook		Chum		Sockeye		Coho		Pink	Longnose Sucker	White-fish	Other	
Date	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Daily	Daily	Daily	Species Code[b]
6/15	0	-	0	-	0	-	0	-	0	16	0	0	
6/16	0	-	1	0	0	-	0	-	0	108	0	0	
6/17	0	-	2	0	0	-	0	-	0	247	0	0	
6/18	0	-	3	0	0	-	0	-	0	447	0	0	
6/19	0	-	0	0	0	-	0	-	0	267	0	0	
6/20	0	-	1	0	0	-	0	-	0	100	0	0	
6/21	2	0	9	0	0	-	0	-	0	67	0	0	
6/22	0	0	2	0	0	-	0	-	0	23	0	0	
6/23	0	0	0	1	0	-	0	-	0	1	0	0	
6/24	0	0	2	1	0	-	0	-	0	1	0	0	
6/25	0	0	7	1	0	-	0	-	0	0	0	0	
6/26	3	0	20	2	0	-	0	-	0	3	0	0	
6/27	4	1	31	3	0	-	0	-	0	20	0	0	
6/28	2	1	20	6	0	-	0	-	0	8	0	0	
6/29	6	2	14	8	0	-	0	-	0	51	0	0	
6/30	3	2	20	13	0	-	0	-	0	45	0	0	
7/1	2	2	33	15	0	-	0	-	0	98	0	0	
7/2	14	3	56	18	0	-	0	-	0	118	0	0	
7/3	1	3	5	12	0	-	0	-	0	45	0	0	
7/4	2	4	50	14	0	-	0	-	0	31	0	0	
7/5	186	21	494	16	0	-	0	-	0	12	0	4	AG
7/6	5	21	79	19	1	1	0	-	0	2	1	2	AG
7/7	163	37	644	22	0	1	0	-	0	10	0	1	NP
7/8	69	43	392	24	0	1	0	-	0	15	0	4;1	AG;DV
7/9	81	**51**	415	29	0	1	0	-	0	14	0	1	NP
7/10	33	54	498	33	0	1	0	-	0	41	0	1	AG
7/11	152	68	680	37	0	1	0	-	0	94	0	0	
7/12	64	74	698	42	1	2	0	-	0	111	4	3	AG
7/13	28	77	723	46	2	4	0	-	0	26	0	0	
7/14	59	82	903	49	3	7	0	-	0	10	0	0	
7/15	12	83	695	**53**	0	7	0	-	0	3	0	0	
7/16	8	84	772	57	1	8	0	-	0	0	0	0	
7/17	6	85	599	61	0	8	0	-	0	0	0	0	
7/18	6	85	764	65	4	12	0	-	0	2	1	0	
7/19	38	89	1,175	68	2	14	0	-	0	0	0	0	
7/20	11	90	955	72	2	16	0	-	0	0	0	0	
7/21	28	92	1,101	75	1	17	0	-	0	0	0	0	
7/22	3	93	793	78	1	18	0	-	0	4	0	0	
7/23	3	93	750	81	1	19	0	-	0	0	0	0	
7/24	7	93	841	83	0	19	1	0	0	0	0	0	
7/25	8	94	765	85	2	21	0	0	0	0	0	1	NP
7/26	5	95	653	87	0	21	2	0	0	0	0	1	NP
7/27	3	95	676	89	2	23	2	0	0	0	0	0	
7/28	7	96	641	90	1	**62**	0	0	0	0	0	0	
7/29	8	96	269	91	2	67	6	0	0	0	0	0	
7/30	4	97	132	93	2	72	9	0	0	0	0	0	
7/31	3	97	374	94	6	87	8	0	0	0	0	0	

-continued-

Table 1.–Page 2 of 3.

	Chinook		Chum		Sockeye		Coho		Pink	Longnose Sucker	White-fish	Other	
Date	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Daily	Daily	Daily	Species Code[b]
8/1	2	97	253	95	0	87	26	1	0	2	0	0	
8/2	3	97	307	96	0	87	24	1	1	0	0	0	
8/3	3	98	360	96	3	95	130	2	0	0	0	0	
8/4	2	98	248	97	0	95	77	3	1	0	0	0	
8/5	2	98	193	97	0	95	61	3	1	0	0	0	
8/6	4	99	164	98	0	95	128	5	0	0	0	0	
8/7	2	99	114	98	1	97	115	6	0	0	0	0	
8/8	1	99	61	98	0	97	90	7	0	0	0	0	
8/9	3	99	94	99	0	97	250	9	0	0	0	0	
8/10	1	99	65	99	0	97	163	11	0	0	0	0	
8/11	1	99	40	99	0	97	36	11	0	0	0	0	
8/12	0	99	15	99	0	97	56	12	0	0	0	0	
8/13	0	99	36	99	0	97	55	12	0	0	0	0	
8/14	1	99	41	99	0	97	310	15	0	0	0	1	AG
8/15	1	99	26	100	0	97	88	16	0	0	0	0	
8/16	2	100	33	100	1	100	609	22	0	0	0	1	AG
8/17	0	100	26	100	0	100	1,539	37	0	0	0	0	
8/18	2	100	12	100	0	100	1,003	47	0	0	0	1	NP
8/19	0	100	10	100	0	100	443	**52**	0	0	0	1	NP
8/20	0	100	6	100	0	100	77	52	0	0	0	0	
8/21	1	100	5	100	0	100	102	53	0	0	0	0	
8/22	0	100	63	100	0	100	76	54	0	0	0	0	
8/23	0	100	14	100	0	100	425	58	0	0	0	0	
8/24	0	100	6	100	0	100	510	63	0	0	0	1	NP
8/25	0	100	3	100	0	100	244	66	0	0	0	1	NP
8/26	0	100	0	100	0	100	18	66	0	0	0	0	
8/27	0	100	0	100	0	100	371	70	0	0	0	0	
8/28	0	100	1	100	0	100	537	75	0	0	0	0	
8/29	1	100	5	100	0	100	619	81	0	0	0	0	
8/30	0	100	2	100	0	100	576	87	0	0	0	0	
8/31	0	100	4	100	0	100	204	89	0	0	0	1	NP
9/1	0	100	1	100	0	100	79	89	0	0	0	0	
9/2	0	100	1	100	0	100	201	91	0	0	0	1	NP
9/3	0	100	0	100	0	100	229	94	0	0	0	0	
9/4	0	100	0	100	0	100	75	94	0	0	0	0	
9/5	0	100	1	100	0	100	102	95	0	0	0	0	
9/6	0	100	0	100	0	100	36	96	0	0	0	0	
9/7	0	100	0	100	0	100	60	96	0	0	0	0	
9/8	0	100	1	100	0	100	74	97	0	0	0	0	
9/9	0	100	1	100	0	100	29	97	0	0	0	0	
9/10	0	100	1	100	0	100	74	98	0	0	0	0	
9/11	0	100	3	100	0	100	38	98	0	0	0	0	
9/12	0	100	1	100	0	100	32	99	0	0	0	0	
9/13	0	100	0	100	0	100	11	99	0	0	0	0	
9/14	0	100	0	100	0	100	12	99	0	0	0	0	
9/15	0	100	1	100	0	100	21	99	0	0	0	0	
9/16	0	100	0	100	0	100	52	100	0	0	0	0	

-continued-

Table 1.–Page 3 of 3.

	Chinook		Chum		Sockeye		Coho		Pink	Longnose Sucker	White-fish	Other	
Date	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Percent Passage	Daily	Daily	Daily	Daily	Species Code[b]
9/17	0	100	0	100	0	100	2	100	0	0	0	0	
9/18	0	100	0	100	0	100	16	100	0	0	0	0	
9/19	0	100	0	100	0	100	11	100	0	0	0	0	
9/20	0	100	0	100	0	100	4	100	0	0	0	0	
9/21 [a]	0	100	0	100	0	100	6	100	0	0	0	0	
9/22 [a]	0	100	0	100	0	100	1	100	0	0	0	0	
Total	1,071		19,975		39		10,148		3	2,042	6		

Note: Boxes represent the central 50% of the run and bold represents the median date of passage.

[a] Outside of "target operational period". Passage not included in season total.

[b] Letter designations are as follows: NP = Northern pike, AG = Arctic grayling, DV = Dolly Varden. Count may not correspond to actual day observed

Table 2.–Age and sex composition of Chinook salmon at the Tatlawiksuk River weir in 2009 based on escapement samples collected with a live trap.

			Age Class																	
Sample Dates	Sample		1.1		1.2		2.2		1.3		1.4		2.3		1.5		2.4		Total	
(Stratum Dates)	Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%
6/30-7/23	42	M	0	0.0	142	14.3	0	0.0	236	23.8	166	16.6	0	0.0	0	0.0	24	2.4	568	57.1
(6/15/-7/23)		F	0	0.0	47	4.7	0	0.0	95	9.5	284	28.6	0	0.0	0	0.0	0	0.0	426	42.9
		Subtotal[a]	0	0.0	189	19.0	0	0.0	331	33.3	450	45.2	0	0.0	0	0.0	24	2.4	994	100.0
7/24-8/09	51	M	0	0.0	12	15.7	0	0.0	4	5.9	5	5.9	0	0.0	0	0.0	0	0.0	21	27.5
(7/24/-9/20)		F	0	0.0	0	0.0	0	0.0	11	13.7	45	58.8	0	0.0	0	0.0	0	0.0	56	72.5
		Subtotal[a]	0	0.0	12	15.7	0	0.0	15	19.6	50	64.7	0	0.0	0	0.0	0	0.0	77	100.0
Season[b]	93	M	0	0.0	154	14.4	0	0.0	241	22.5	170	15.9	0	0.0	0	0.0	24	2.2	589	55.0
		F	0	0.0	47	4.4	0	0.0	105	9.8	329	30.7	0	0.0	0	0.0	0	0.0	482	45.0
		Total	0	0.0	201	18.8	0	0.0	346	32.3	499	46.6	0	0.0	0	0.0	24	2.2	1,071	100.0
		95% C.I.				(± 10.9)				(± 13.1)		(± 13.9)								

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.
[b] The number of fish in "Season" summaries are the strata sums; "Season" percentages are derived from the sums of the estimated escapement.

Table 3.–Mean length (mm) of Chinook salmon at the Tatlawiksuk River weir in 2009 based on escapement samples taken from the live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 1.2	1.3	1.4	2.3	1.5	2.4
6/30-7/23 (6/15/-7/23)	M	Mean Length	590	650	730			-
		SE[b]	-	16	-			-
		Range	526-623	573-724	703-767			
		Sample Size	6	10	7	0	0	1
	F	Mean Length	567	667	802			
		SE[b]	-	-	12			
		Range	546-587	623-733	726-870			
		Sample Size	2	4	12	0	0	0
7/24-8/9 (07/24/-9/20)	M	Mean Length	585	643	758			
		SE[b]	-	-				
		Range	486-667	613-733	724-793			
		Sample Size	8	4	3	0	0	0
	F	Mean Length		697	827			
		SE[b]		-	12			
		Range		621-789	710-965			
		Sample Size	0	7	30	0	0	0
Season[a]	M	Mean Length	589	650	733			-
		SE[b]	14	15	9			-
		Range	486-667	573-724	703-793			
		Sample Size	14	13	10	0	0	1
	F	Mean Length	567	669	803			
		SE[b]	-	22	11			
		Range	546-587	621-789	710-965			
		Sample Size	2	11	42	0	0	0

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 2.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

[b] Standard error was not calculated for small sample sizes.

Table 4.–Age and sex composition of chum salmon at the Tatlawiksuk River weir in 2009 based on escapement samples collected with a live trap.

			Age Class									
			0.2		0.3		0.4		0.5		Total	
Sample Dates (Stratum Dates)	Sample Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%
7/8-16 (6/15-7/17)	223	M	212	2.7	2,258	28.7	1,517	19.3	459	5.8	4,446	56.5
		F	70	0.9	2,223	28.3	988	12.5	141	1.8	3,422	43.5
		Subtotal[a]	282	3.6	4,481	57.0	2,505	31.8	600	7.6	7,868	100.0
7/19-23 (7/18-24)	207	M	216	3.4	2,065	32.4	431	6.8	31	0.5	2,743	43.0
		F	493	7.7	2,342	36.7	740	11.6	61	0.9	3,636	57.0
		Subtotal[a]	709	11.1	4,407	69.1	1,171	18.4	92	1.4	6,379	100.0
7/26-8/4 (7/25-9/20)	399	M	258	4.5	1,651	28.8	459	8.0	43	0.8	2,412	42.1
		F	316	5.5	2,326	40.6	646	11.3	29	0.5	3,316	57.9
		Subtotal[a]	574	10.0	3,977	69.4	1,105	19.3	72	1.3	5,728	100.0
Season[b]	829	M	686	3.4	5,974	29.9	2,408	12.0	533	2.7	9,600	48.1
		F	879	4.4	6,890	34.5	2,373	11.9	231	1.1	10,375	51.9
		Total	1,565	7.8	12,864	64.4	4,781	23.9	764	3.8	19,975	100.0
		95% C.I.		(± 1.8)		(± 3.5)		(± 3.1)		(± 1.5)		

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 5.–Mean length (mm) of chum salmon at the Tatlawiksuk River weir in 2009 based on escapement samples taken from the live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
7/8-16 (6/15-7/17)	M	Mean Length	534	566	572	578
		SE	-	4	5	6
		Range	490- 583	443- 639	512- 643	556- 617
		Sample Size	6	64	43	13
	F	Mean Length	514	529	538	537
		SE	-	3	5	-
		Range	496- 531	477- 577	475- 583	509- 557
		Sample Size	2	63	28	4
7/19-23 (7/18-24)	M	Mean Length	542	553	564	543
		SE[b]	-	4	9	-
		Range	515- 581	438- 620	509- 626	543- 543
		Sample Size	7	67	14	1
	F	Mean Length	507	526	542	531
		SE[b]	6	3	4	-
		Range	444- 531	449- 585	509- 586	514- 547
		Sample Size	16	76	24	2
7/26-8/4 (7/25-9/20)	M	Mean Length	505	555	549	552
		SE[b]	10	3	7	-
		Range	445- 576	480- 630	463- 630	520- 598
		Sample Size	18	115	32	3
	F	Mean Length	496	518	521	516
		SE[b]	7	2	5	-
		Range	442- 552	450- 627	430- 607	504- 528
		Sample Size	22	162	45	2
Season[a]	M	Mean Length	526	558	566	574
		SE[b]	6	2	3	5
		Range	445- 583	438- 639	463- 643	520- 617
		Sample Size	31	246	89	17
	F	Mean Length	503	524	535	533
		SE[b]	4	2	3	-
		Range	442- 552	449- 627	430- 607	504- 557
		Sample Size	40	301	97	8

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 4.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

[b] Standard error was not calculated for small sample sizes.

Table 6.–Age and sex composition of coho salmon at the Tatlawiksuk River weir in 2009 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 1.1 Esc.	1.1 %	2.1 Esc.	2.1 %	3.1 Esc.	3.1 %	Total Esc.	Total %
8/12-17	169	M	189	3.5	2,575	48.5	251	4.8	3,015	56.8
(6/15-8/20)		F	31	0.6	1,979	37.3	283	5.3	2,293	43.2
		Subtotal[a]	220	4.1	4,554	85.8	534	10.1	5,308	100.0
8/23-28	165	M	176	6.1	1,390	47.9	105	3.6	1,671	57.6
(8/21-29)		F	70	2.4	1,020	35.1	141	4.9	1,231	42.4
		Subtotal[a]	246	8.5	2,410	83.0	246	8.5	2,902	100.0
8/31-9/5	174	M	67	3.5	490	25.3	56	2.9	613	31.6
(8/30-9/20)		F	111	5.7	1,058	54.6	156	8.0	1,325	68.4
		Subtotal[a]	178	9.2	1,548	79.9	212	10.9	1,938	100.0
Season[b]	508	M	431	4.2	4,455	43.9	413	4.1	5,299	52.2
		F	213	2.1	4,057	40.0	579	5.7	4,849	47.8
		Total	644	6.3	8,512	83.9	992	9.8	10,148	100.0
		95% C.I.		(± 2.2)		(± 3.3)		(± 2.7)		

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 7.–Mean length (mm) of coho salmon at the Tatlawiksuk River weir in 2009 based on escapement samples taken from the live trap.

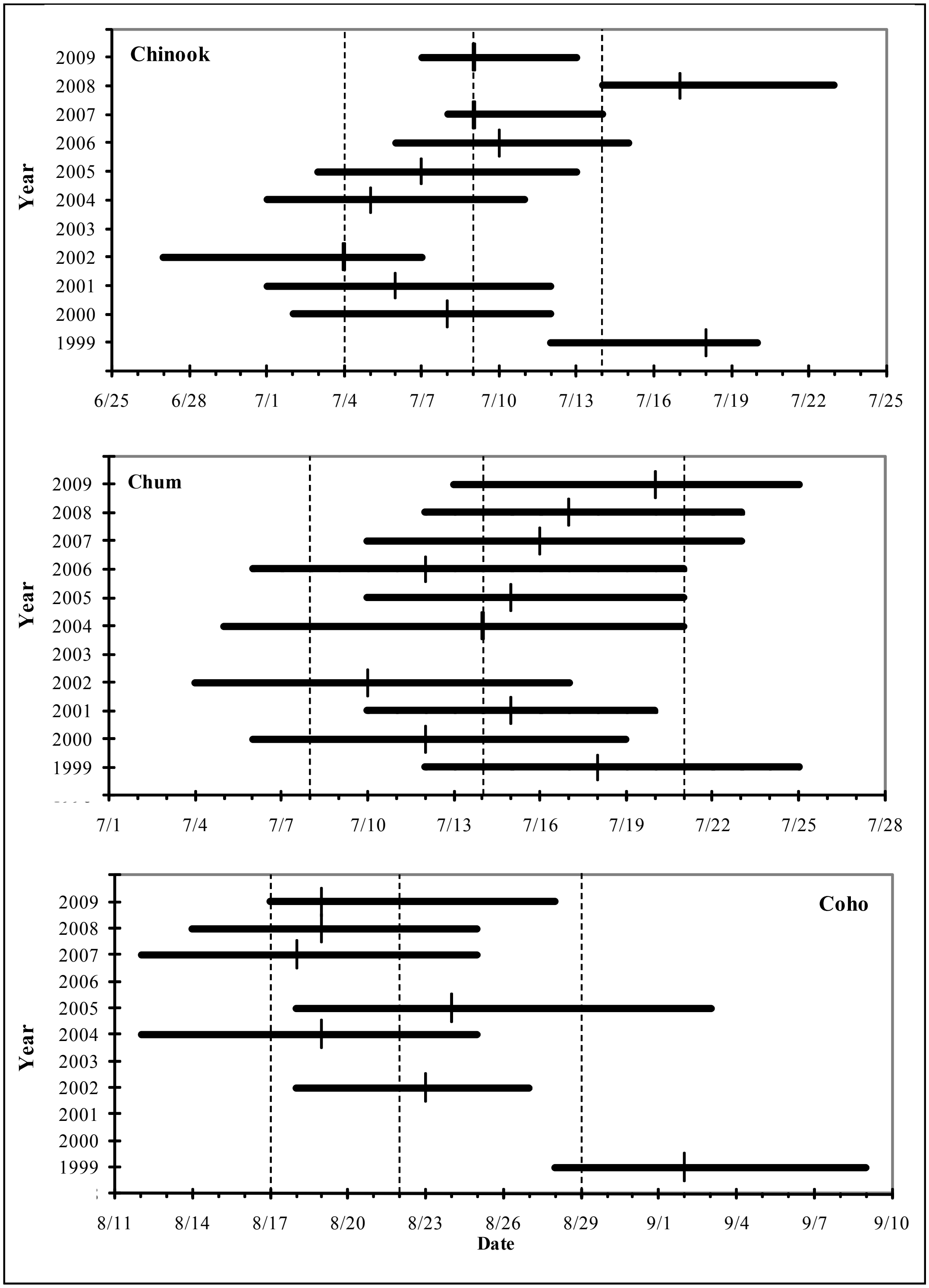
Sample Dates			Age Class		
(Stratum Dates)	Sex		1.1	2.1	3.1
8/12-17	M	Mean Length	486	544	518
(6/15-8/20)		SE[b]	-	6	-
		Range	426- 532	369- 629	421- 591
		Sample Size	6	82	8
	F	Mean Length	568	551	549
		SE[b]	-	4	13
		Range	568- 568	449- 609	477- 601
		Sample Size	1	63	-
8/23-28	M	Mean Length	529	554	563
(8/21-29)		SE[b]	16	5	-
		Range	450- 609	426- 636	534- 594
		Sample Size	10	79	6
	F	Mean Length	541	562	561
		SE[b]	-	4	-
		Range	491- 574	446- 608	492- 592
		Sample Size	4	58	8
8/31-9/5	M	Mean Length	541	556	532
(8/30-9/20)		SE[b]	-	7	-
		Range	522- 578	427- 616	430- 604
		Sample Size	6	44	5
	F	Mean Length	552	563	568
		SE[b]	14	3	5
		Range	472- 614	380- 623	537- 600
		Sample Size	10	95	14
Season[a]	M	Mean Length	512	549	531
		SE[b]	9	4	13
		Range	426- 609	369- 636	421- 604
		Sample Size	22	205	19
	F	Mean Length	551	557	557
		SE[b]	9	3	7
		Range	472- 614	380- 623	477- 601
		Sample Size	15	216	31

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 6.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

[b] Standard error was not calculated for small sample sizes.

Figure 1.–Map depicting the location of Kuskokwim Area salmon management districts and escapement monitoring on the Tatlawiksuk River.



Note: Solid lines represent the dates when the central 50% of the run passed and cross-bars represent median passage dates. Vertical dashed lines represent mean historical passage dates of 25th percentile, median, and 75th percentile escapement. Years when high water precluded run timing estimates are indicated by no data.

Figure 2.–Run timing of Chinook, chum, and coho salmon based on cumulative percent passage at the Tatlawiksuk River weir, 1999–2009.

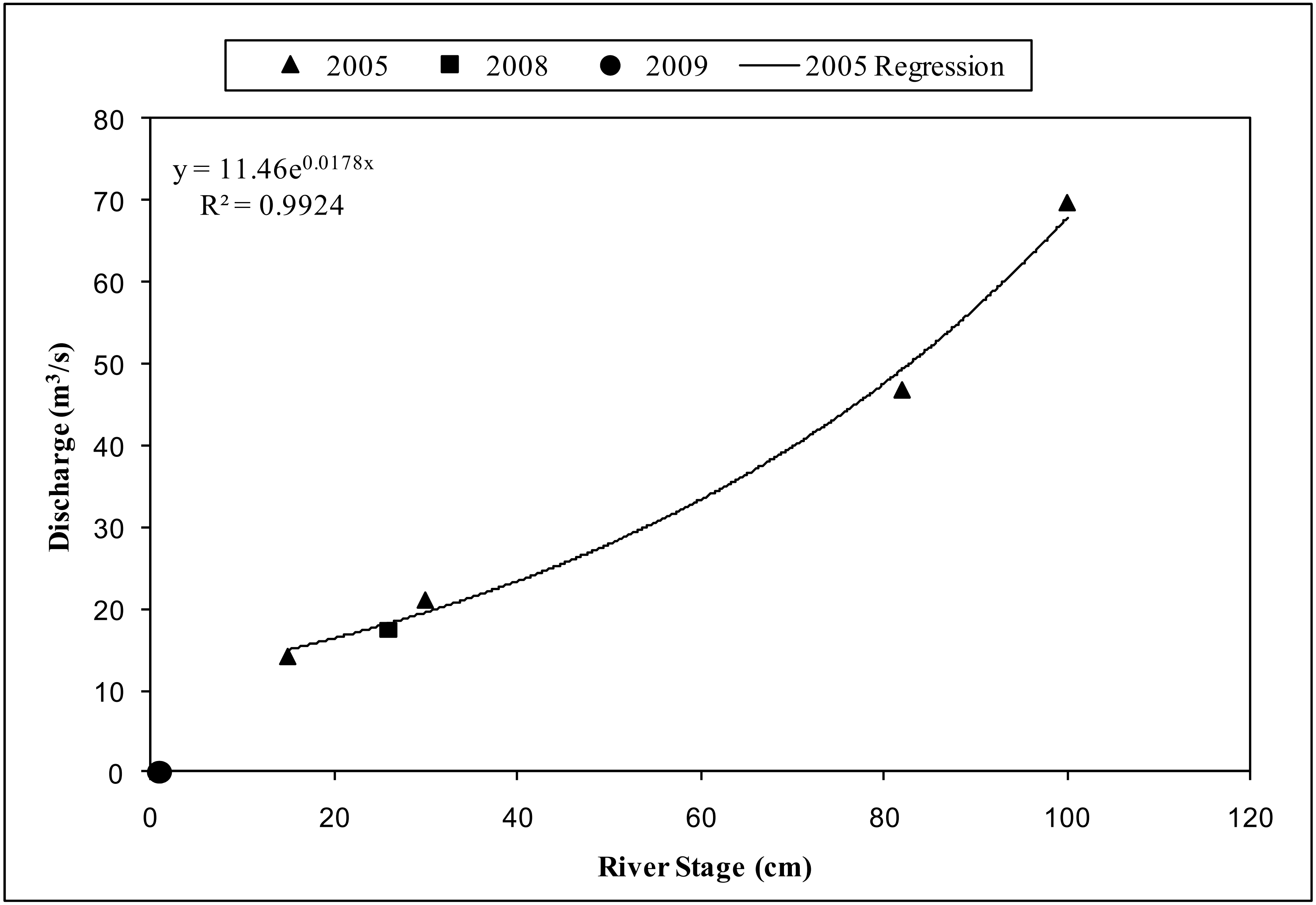


Figure 3.–Stage discharge relationship from Costello et al. (2006) compared to 2008 and 2009 discharge measurements.

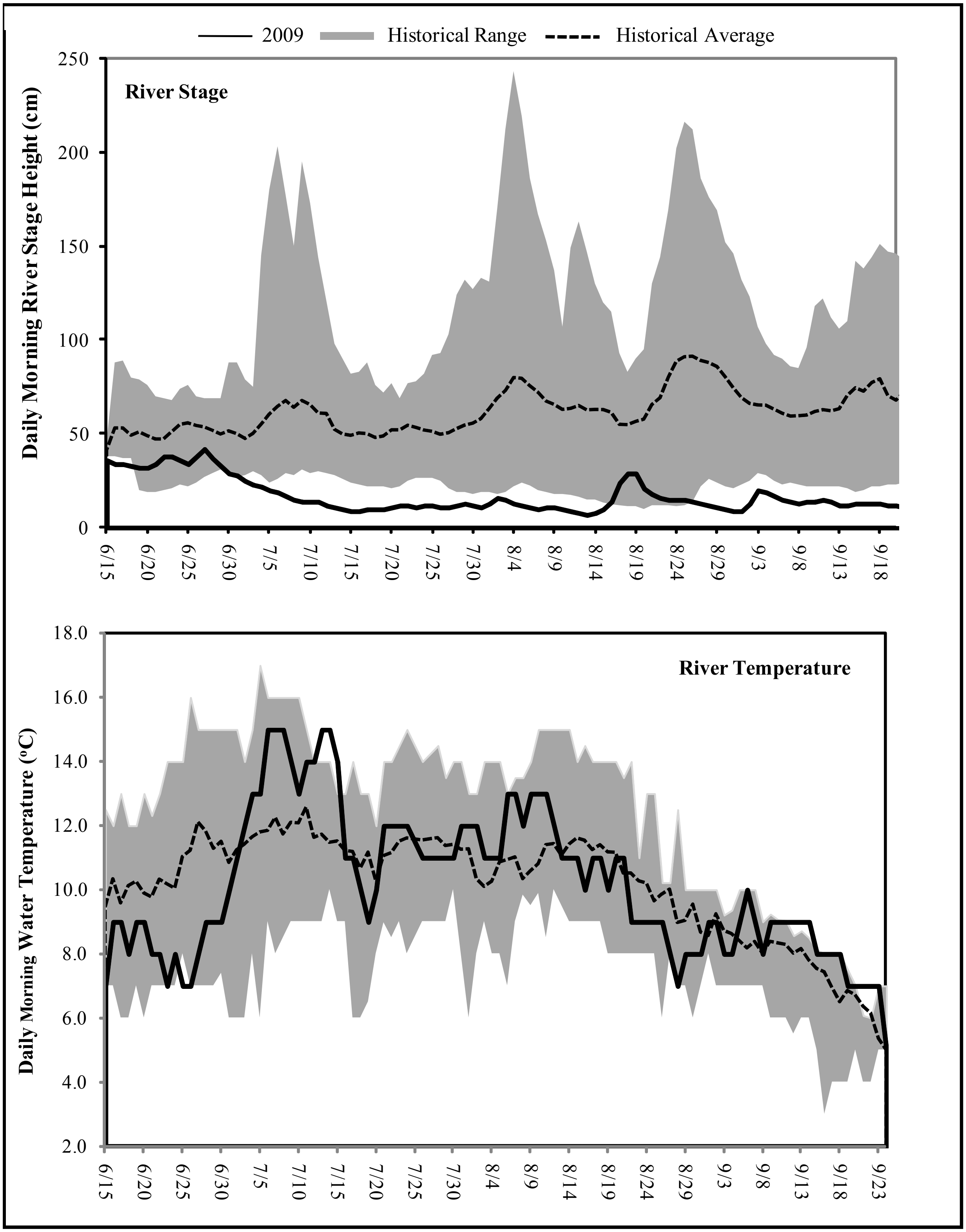
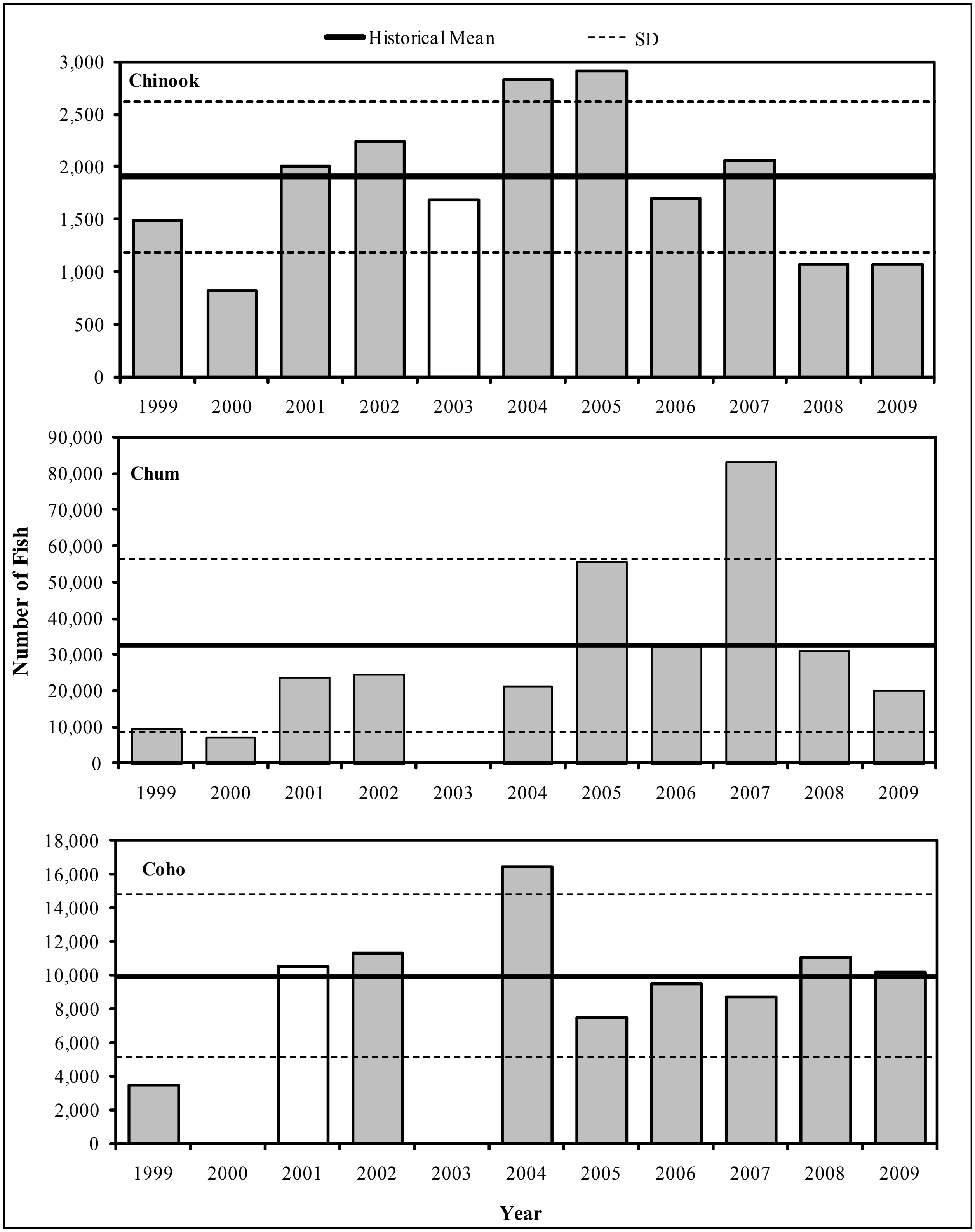
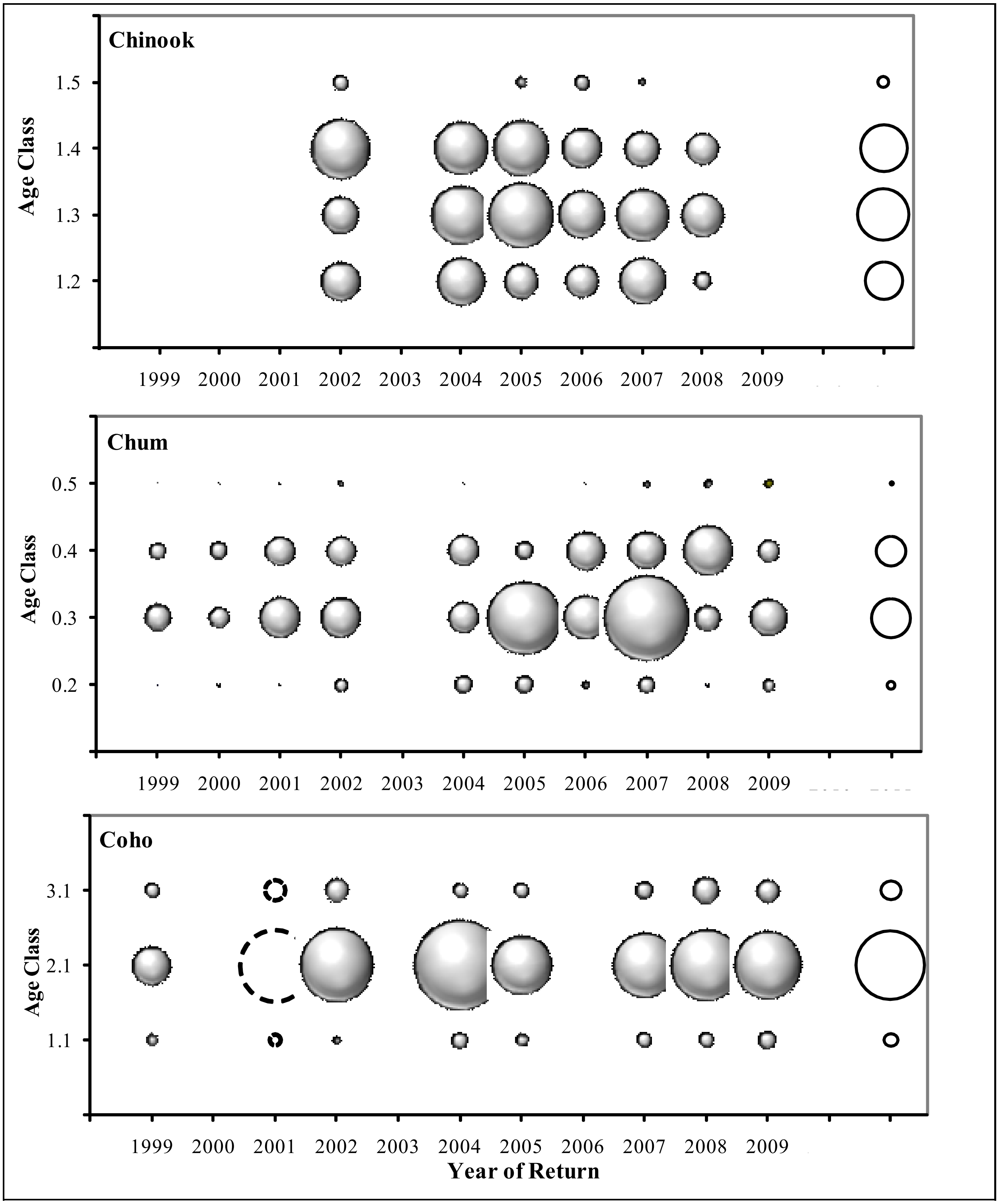


Figure 4.–Comparison of daily morning river stage and temperature measurements in 2009 with historical range and averages at Tatlawiksuk River weir.



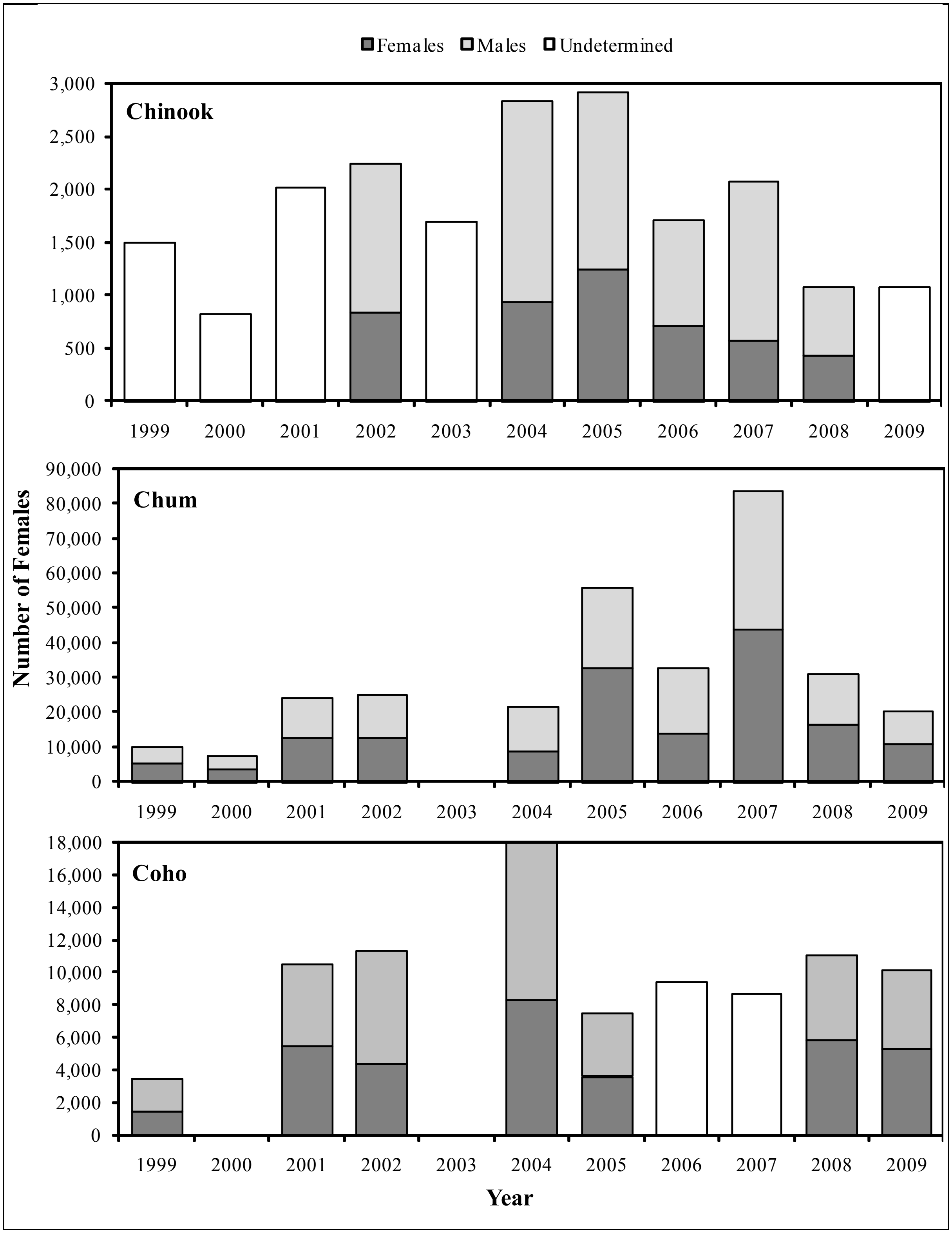
Note: Open bars represent years when estimates of missed passage exceeded 20%, and were not used to calculate historical statistics. SD = Standard deviation of mean historical escapement.

Figure 5.–Historical escapement of salmon at the Tatlawiksuk River.



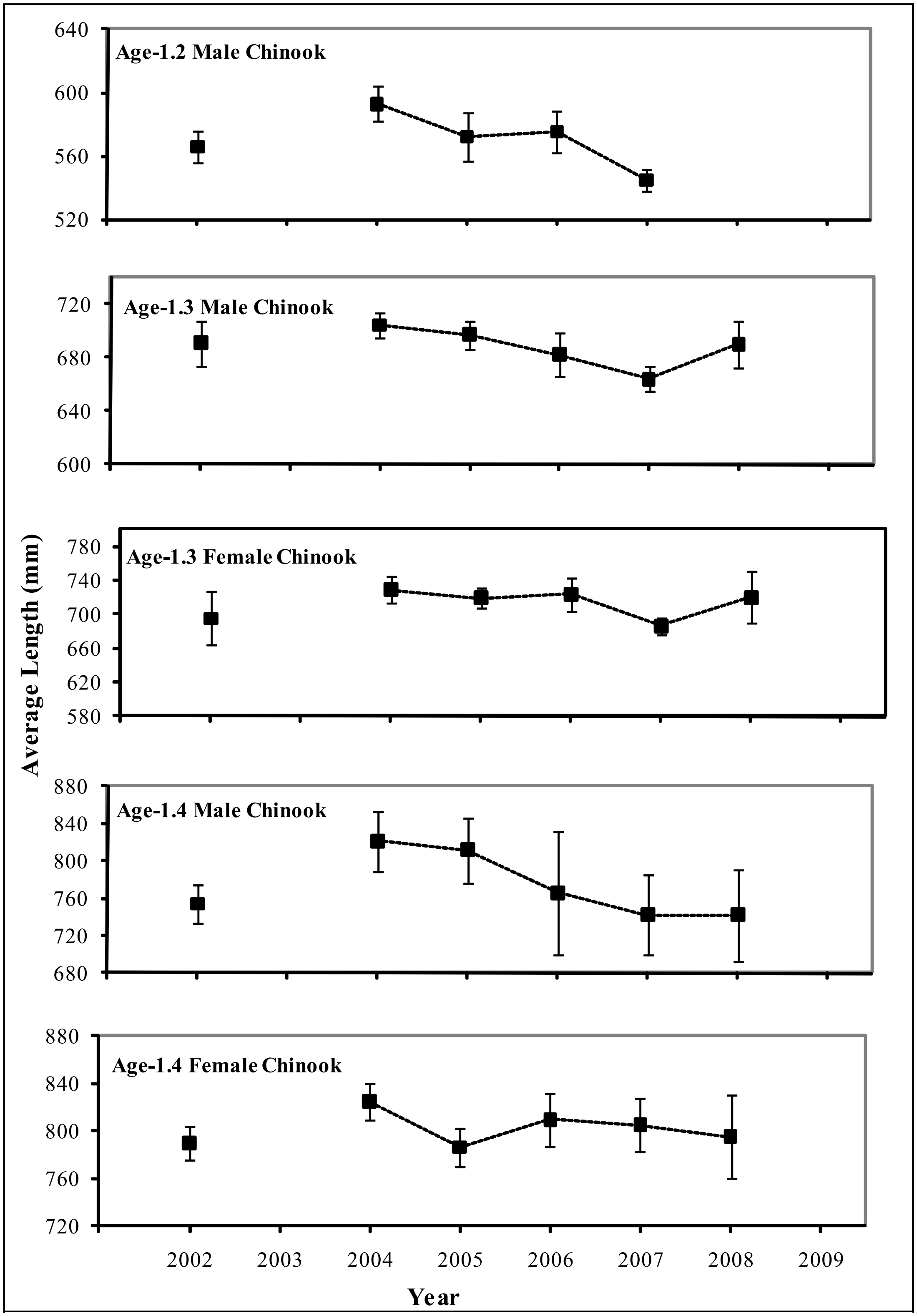
Note: Size of circles represents relative abundance. Plots with a dashed perimeter correspond to years when greater than 20% of reported escapement was derived from daily passage estimates. Years when samples were not adequate to estimate age composition contain no data plots.

Figure 6.–Relative age-class abundance of Chinook, chum, and coho salmon by return year at Tatlawiksuk River weir, showing historic mean with open plots.



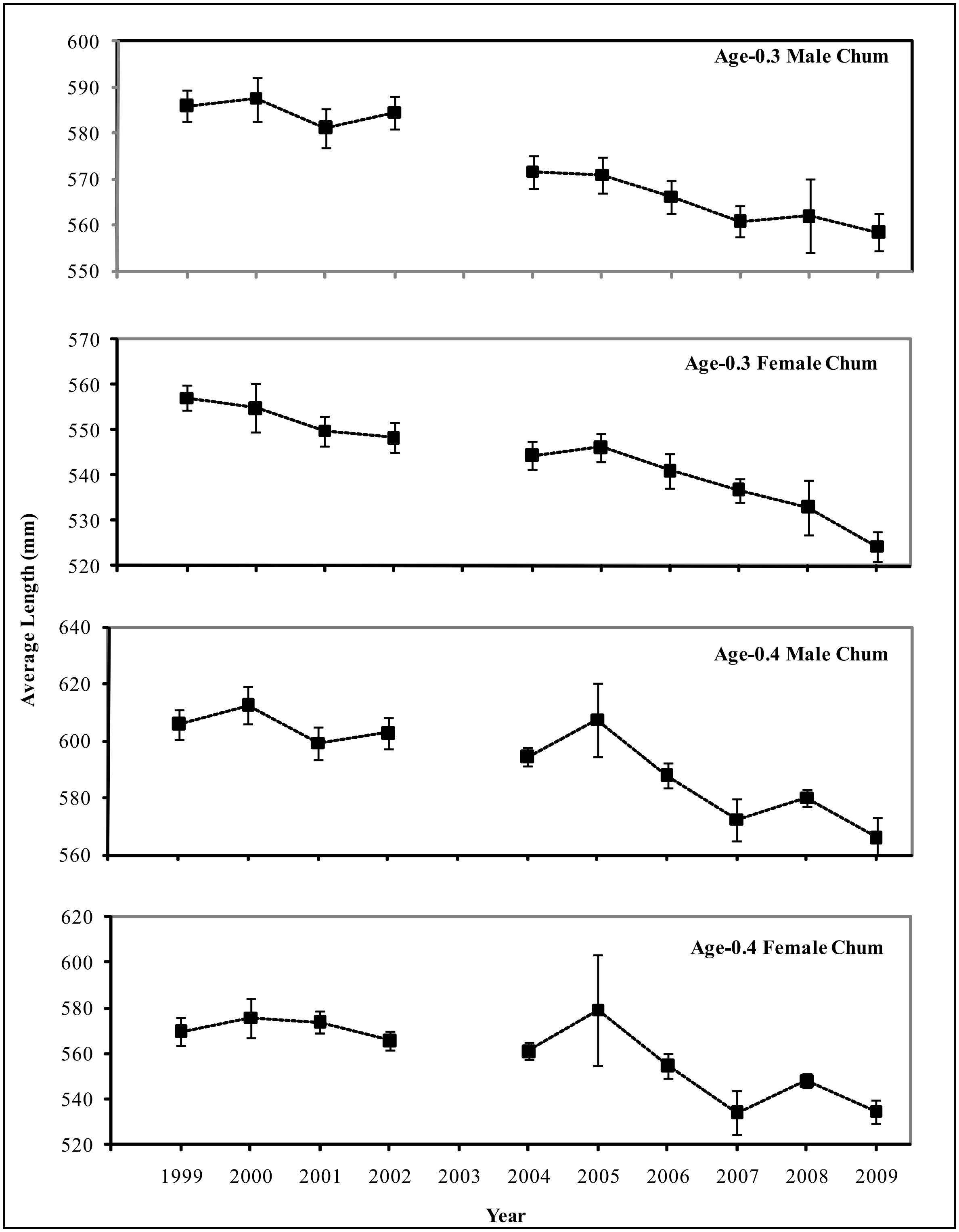
Note: Open bars indicate years when samples were not sufficient to produce sex composition.

Figure 7.–Historical escapement of salmon at Tatlawiksuk River weir, showing relative abundance of males and females.



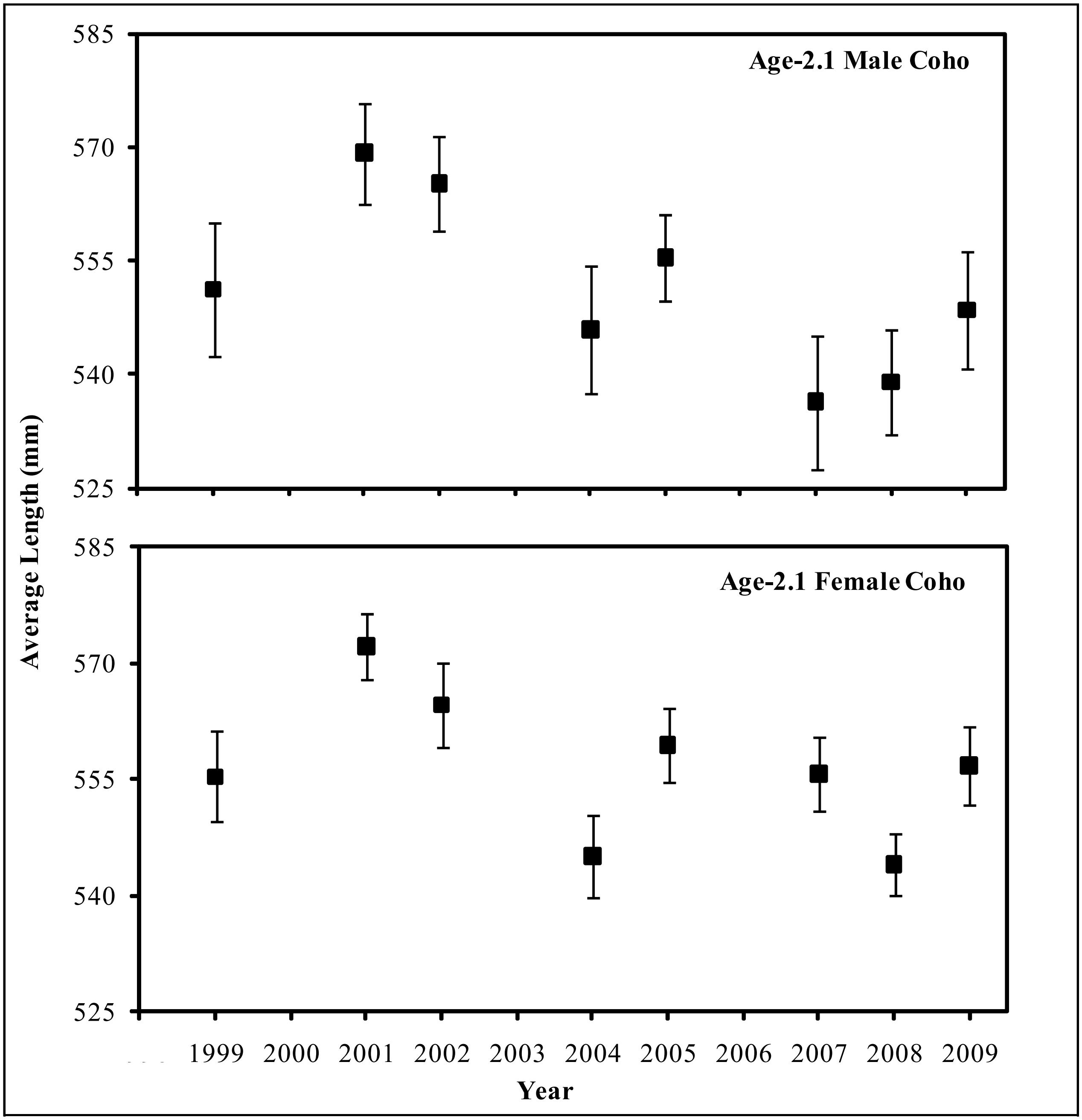
Note: Years without plots indicate that either sampling was insufficient for ASL analysis or confidence intervals were so large that they would skew the scale of the figure.

Figure 8.–Historical average length for Chinook salmon at the Tatlawiksuk River weir, with 95% confidence intervals.



Note: Years without plots indicate that either sampling was insufficient for ASL analysis or confidence intervals were so large that they would skew the scale of the figure.

Figure 9.–Historical average length for chum salmon at Tatlawiksuk River weir, with 95% confidence intervals.



Note: Years without plots indicate that either sampling was insufficient for ASL analysis or confidence intervals were so large that they would skew the scale of the figure.

Figure 10.–Historical mean length of coho salmon at Tatlawiksuk River weir, with 95% confidence intervals.

APPENDIX A: WEATHER AND STREAM OBSERVATIONS

Appendix A.–Daily weather and stream observations at the Tatlawiksuk River weir site, 2009.

Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C)		River Stage (cm)	Water Clarity[c]
				Air	Water		
6/14	10:00	4	3.6	ND	ND	ND	ND
6/15	10:00	1	0.0	10.0	7.0	36	2
	17:00	3	0.0	23.0	9.0	36	2
6/16	10:00	5	1.0	10.0	9.0	34	2
	17:00	3	0.0	18.0	11.0	34	2
6/17	10:00	3	1.0	8.0	9.0	34	2
	17:00	1	0.0	16.0	10.0	34	2
6/18	10:00	1	0.0	11.0	8.0	33	2
	17:00	2	0.0	16.0	11.0	33	2
6/19	10:00	2	0.0	10.0	9.0	32	2
	17:00	3	0.0	18.0	12.0	32	2
6/20	10:00	4	8.4	7.0	9.0	32	2
	17:00	3	1.4	13.0	10.0	33	2
6/21	10:00	4	0.7	8.0	8.0	34	2
	17:00	3	0.3	12.0	9.0	34	2
6/22	10:00	3	1.6	6.0	8.0	38	2
	17:00	4	0.0	11.0	9.0	40	2
6/23	10:00	4	2.6	6.0	7.0	38	2
	17:00	3	0.0	12.0	9.0	38	2
6/24	9:15	3	0.5	9.0	8.0	36	2
	17:00	4	0.0	11.0	8.0	34	2
6/25	10:00	4	5.8	6.0	7.0	34	2
	17:00	4	2.2	10.0	8.0	35	2
6/26	9:30	4	2.6	9.0	7.0	38	2
	17:00	3	0.0	12.0	9.0	39	2
6/27	10:00	1	0.0	10.0	8.0	42	2
	17:00	1	0.0	12.0	10.0	40	2
6/28	10:00	2	0.0	10.0	9.0	37	2
	17:00	3	0.0	13.0	10.0	36	2
6/29	10:00	2	0.0	13.0	9.0	33	2
	17:00	2	0.0	18.0	12.0	33	2
6/30	10:00	1	0.0	13.0	9.0	29	2
	17:00	1	0.0	21.0	12.0	29	2
7/1	10:00	1	0.0	13.0	10.0	28	2
	17:00	1	0.0	23.0	13.0	27	2
7/2	10:00	1	0.0	17.0	11.0	25	2
	17:00	1	0.0	25.0	15.0	25	2
7/3	10:00	1	0.0	15.0	12.0	23	2
	17:00	1	0.0	19.0	16.0	23	2
7/4	10:00	1	0.0	14.0	13.0	22	2
	17:00	1	0.0	22.0	15.0	22	2
7/5	10:00	1	0.0	18.0	13.0	20	2
	17:00	1	0.0	26.0	16.0	20	1
7/6	10:00	1	0.0	20.0	15.0	19	1
	17:00	1	0.0	28.0	17.0	18	1
7/7	10:00	1	0.0	18.0	15.0	17	1
	17:00	1	0.0	29.0	18.0	16	1
7/8	10:00	4	0.0	15.0	15.0	15	1
	17:00	4	0.0	15.0	16.0	14	1
7/9	10:00	4	0.0	13.0	14.0	14	1
	17:00	1	0.0	16.0	15.0	14	1
7/10	7:30	1	0.0	10.0	13.0	14	1
	10:00	1	0.0	15.0	14.0	14	1

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Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Temperature (°C) Water	River Stage (cm)	Water Clarity[c]
	17:00	1	0.0	24.0	16.0	14	1
7/11	10:00	1	0.0	16.0	14.0	14	1
	17:00	1	0.0	27.0	17.0	13	1
7/12	10:00	1	0.0	15.0	14.0	12	1
	17:00	1	0.0	24.0	16.0	12	1
7/13	10:00	1	0.0	10.0	15.0	11	1
	17:00	1	0.0	26.0	17.0	11	1
7/14	10:00	4	0.0	16.0	15.0	10	1
	17:00	3	0.0	20.0	16.0	10	1
7/15	10:00	4	0.0	14.0	14.0	9	1
	17:00	4	0.0	19.0	14.0	9	1
7/16	10:00	4	0.0	14.0	11.0	9	1
	17:00	4	0.0	17.0	13.0	9	1
7/17	10:00	4	0.0	15.0	11.0	10	1
	17:00	4	0.0	16.0	12.0	10	1
7/18	10:00	4	0.0	12.0	10.0	10	1
	17:00	4	0.0	17.0	13.0	10	1
7/19	10:00	4	1.0	12.0	9.0	10	1
	17:00	4	0.7	16.0	12.0	10	1
7/20	10:00	4	0.2	12.0	10.0	11	1
	17:00	4	0.0	17.0	15.0	10	1
7/21	10:00	3	0.0	14.0	12.0	12	1
	17:00	4	0.1	16.0	13.0	12	1
7/22	10:00	2	0.0	14.0	12.0	12	1
	17:00	3	0.0	18.0	14.0	12	1
7/23	10:00	4	0.0	10.0	12.0	11	1
	17:00	2	0.0	18.0	14.0	12	1
7/24	10:00	4	5.0	10.0	12.0	12	1
	17:00	4	0.0	14.0	12.0	12	1
7/25	10:00	4	0.0	11.0	11.0	12	1
	17:00	4	0.0	17.0	12.0	12	1
7/26	10:00	4	3.4	10.0	11.0	11	1
	17:00	4	0.3	14.0	11.0	11	1
7/27	10:30	4	0.0	10.0	11.0	11	1
	17:00	4	6.0	15.0	11.0	11	1
7/28	10:00	4	1.2	11.0	11.0	12	1
	17:00	4	0.0	18.0	12.0	12	1
7/29	10:00	3	3.8	18.0	12.0	13	1
	17:00	1	0.0	17.0	14.0	12	1
7/30	10:00	2	0.0	10.0	12.0	12	1
	17:00	4	0.0	16.0	13.0	11	1
7/31	10:00	4	9.6	7.0	12.0	11	1
	17:00	4	3.0	10.0	12.0	11	1
8/1	10:00	4	0.5	8.0	11.0	13	1
	17:00	3	0.3	15.0	12.0	14	1
8/2	10:00	2	0.2	12.0	11.0	16	1
	17:00	4	0.1	14.0	12.0	16	1
8/3	10:00	1	0.6	13.0	11.0	15	1
	17:00	1	0.0	25.0	13.0	14	1
8/4	10:00	4	0.1	14.0	13.0	13	1
	17:00	4	0.0	20.0	13.0	12	1
8/5	10:00	4	0.6	13.0	13.0	12	1
	17:00	4	0.0	17.0	13.0	11	1

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Appendix A.–Page 3 of 4.

Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Temperature (°C) Water	River Stage (cm)	Water Clarity[c]
8/6	10:00	4	0.0	11.0	12.0	11	1
	17:00	1	0.0	17.0	14.0	11	1
8/7	10:00	3	0.0	11.0	13.0	10	1
	17:00	3	0.0	17.0	14.0	10	1
8/8	10:00	4	0.0	14.0	13.0	11	1
	17:00	4	0.0	18.0	14.0	11	1
8/9	10:00	3	0.0	15.0	13.0	11	1
	17:00	2	0.0	20.0	14.0	11	1
8/10	10:00	1	0.0	12.0	12.0	10	1
	17:00	1	0.0	17.0	14.0	10	1
8/11	10:00	1	0.0	11.0	11.0	9	1
	17:00	1	0.0	18.0	13.0	8	1
8/12	10:00	3	0.0	7.0	11.0	8	1
	17:00	3	0.0	19.0	12.0	7	1
8/13	10:00	4	3.4	9.0	11.0	7	1
	17:00	4	1.4	11.0	11.0	7	1
8/14	10:00	4	10.5	11.0	10.0	8	1
	17:00	4	1.4	15.0	11.0	8	1
8/15	10:00	4	11.0	11.0	11.0	10	1
	17:00	3	1.2	14.0	12.0	12	1
8/16	10:00	5	8.5	10.0	11.0	14	1
	17:00	2	0.0	17.0	13.0	16	1
8/17	10:00	1	0.0	6.0	10.0	24	2
	17:00	1	0.0	18.0	13.0	28	2
8/18	10:00	3	0.0	10.0	11.0	29	2
	17:00	4	0.0	13.0	12.0	28	2
8/19	10:00	4	0.0	9.0	11.0	29	1
	17:00	2	0.0	15.0	12.0	24	1
8/20	10:00	1	0.0	5.0	9.0	21	1
	17:00	1	0.0	11.0	12.0	20	1
8/21	10:00	4	0.0	4.0	9.0	18	1
	17:00	4	0.0	13.0	10.0	18	1
8/22	10:00	4	1.2	9.0	9.0	16	1
	17:00	4	1.2	10.0	11.0	16	1
8/23	10:00	2	0.0	8.0	9.0	15	1
	17:00	2	0.8	11.0	10.0	15	1
8/24	10:00	2	0.0	8.0	9.0	15	1
	17:00	2	0.0	11.0	10.0	15	1
8/25	10:00	2	0.0	8.0	8.0	15	1
	17:00	2	0.0	9.0	10.0	15	1
8/26	10:00	1	0.0	6.0	7.0	14	1
	17:00	1	0.0	15.0	10.0	14	1
8/27	10:00	4	0.8	7.0	8.0	13	1
	17:00	1	0.0	15.0	9.0	12	1
8/28	10:00	1	0.0	10.0	8.0	12	1
	17:00	1	0.0	14.0	10.0	12	1
8/29	10:00	1	0.0	9.0	8.0	11	1
	17:00	1	0.0	17.0	10.0	10	1
8/30	10:00	4	0.0	9.0	9.0	10	1
	17:00	3	0.0	13.0	10.0	10	1
8/31	10:00	4	4.0	8.0	9.0	9	1
	17:00	4	4.0	9.0	9.0	9	1
9/1	10:00	4	1.0	8.0	8.0	9	1
	17:00	4	7.0	10.0	9.0	9	1

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Appendix A.–Page 4 of 4.

Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Temperature (°C) Water	River Stage (cm)	Water Clarity[c]
9/2	10:00	4	8.2	9.0	8.0	13	1
	17:00	4	0.0	12.0	10.0	15	1
9/3	10:00	3	0.0	10.0	9.0	20	1
	17:00	1	0.0	18.0	11.0	20	1
9/4	10:00	1	0.0	12.0	10.0	19	1
	17:00	1	0.0	22.0	12.0	18	1
9/5	10:00	1	0.0	7.0	9.0	17	1
	17:00	1	0.0	21.0	11.0	16	1
9/6	10:00	1	0.0	5.0	8.0	15	1
	17:00	1	0.0	19.0	11.0	14	1
9/7	10:00	1	0.0	7.0	9.0	14	1
	17:00	2	0.0	8.0	11.0	14	1
9/8	10:00	5	2.0	7.0	9.0	13	1
	17:00	2	0.0	15.0	10.0	13	1
9/9	10:00	4	0.0	5.0	9.0	14	1
	17:00	4	0.0	14.0	10.0	14	1
9/10	10:00	1	1.8	9.0	9.0	14	1
	17:00	1	0.0	17.0	11.0	14	1
9/11	10:00	1	0.0	5.0	9.0	15	1
	17:00	1	0.0	7.0	11.0	15	1
9/12	10:00	4	2.0	5.0	9.0	14	1
	17:00	2	0.0	7.0	10.0	14	1
9/13	10:00	2	0.0	5.0	8.0	12	1
	17:00	2	0.0	15.0	10.0	12	1
9/14	10:00	5	0.0	3.0	8.0	12	1
	17:00	2	0.0	16.0	9.0	12	1
9/15	10:00	4	2.2	6.0	8.0	13	1
	17:00	2	0.0	15.0	9.0	13	1
9/16	10:00	4	0.0	9.0	8.0	13	1
	17:00	4	0.0	13.0	8.0	13	1
9/17	10:00	3	0.0	2.0	7.0	13	1
	17:00	2	0.0	16.0	8.0	13	1
9/18	10:00	3	0.0	2.0	7.0	13	1
	17:00	3	0.0	15.0	8.0	12	1
9/19	10:00	3	0.0	2.0	7.0	12	1
	17:00	2	0.0	17.0	8.0	12	1
9/20	10:00	3	0.0	6.0	7.0	12	1
	17:00	1	0.0	13.0	8.0	11	1
9/21	10:00	4	0.9	4.0	7.0	11	1
	17:00	4	0.0	6.0	7.0	10	1
9/22	10:00	4	0.0	0.0	5.0	10	1
	17:00	4	0.0	5.0	5.0	10	1
9/23	10:00	4	0.0	1.0	5.0	10	1
	17:00	3	0.0	7.0	5.0	ND	1
9/24	10:00	1	0.0	-3.0	3.0	ND	1
	17:00	4	0.0	5.0	4.0	ND	1
9/25	10:00	4	0.0	2.0	3.0	ND	1
	17:00	4	0.5	2.0	3.0	ND	1
9/26	10:00	4	12.7	0.0	ND	ND	1

[a] Sky condition codes:
0 = no observation
1 = clear or mostly clear; <10% cloud cover
2 = partly cloudy; <50% cloud cover
3 = mostly cloudy; >50% cloud cover
4 = complete overcast
5 = thick fog

[b] Represents the cumulative precipitation in the 24 hours prior to the daily morning observation.

[c] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 mete
3 = visibility less than 0.5 meter

APPENDIX B: DAILY CARCASS COUNTS

Appendix B.–Daily carcass counts at the Tatlawiksuk River weir, 2009.

	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose	White-	
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Sucker	fish	Other[a]
6/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
6/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	
6/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
7/2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
7/7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	
7/8	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	10	1 NP
7/9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/12	0	0	0	0	0	0	5	0	5	0	0	0	0	0	0	0	2	3 AG
7/13	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	2	0	
7/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/15	0	0	0	0	0	0	8	6	14	0	0	0	0	0	0	0	1	
7/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/17	0	0	0	0	0	0	12	4	16	0	0	0	0	0	0	2	0	
7/18	0	0	0	0	0	0	4	3	7	0	0	0	0	0	0	1	0	
7/19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
7/20	0	0	0	0	0	0	5	5	10	0	0	0	0	0	0	0	0	
7/21	0	0	0	0	0	0	10	5	15	0	0	0	0	0	0	0	0	

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Appendix B.–Page 2 of 3.

Date	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose Sucker	White-fish	Other[a]
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total			
7/22	0	0	0	0	0	0	4	4	8	0	0	0	0	0	0	8	2	
7/23	0	0	0	0	0	0	7	0	7	0	0	0	0	0	0	5	0	
7/24	0	0	0	0	0	0	3	2	5	0	0	0	0	0	0	0	0	
7/25	0	0	0	0	0	0	7	3	10	0	0	0	0	0	0	0	0	
7/26	0	0	0	0	0	0	8	3	11	0	0	0	0	0	0	2	0	1 NP
7/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7/29	0	0	0	0	0	0	16	3	19	0	0	0	0	0	0	4	0	
7/30	0	0	0	0	0	0	7	3	10	0	0	0	0	0	0	5	0	
7/31	0	0	0	0	0	0	4	2	6	0	0	0	1	0	1	1	0	
8/1	0	0	0	0	0	0	14	3	17	0	0	0	0	0	0	1	0	
8/2	0	0	0	0	0	0	13	12	25	1	0	1	1	0	1	6	6	
8/3	0	0	0	0	0	0	21	21	42	0	0	0	1	0	1	7	1	
8/4	0	1	1	0	0	0	21	13	34	0	0	0	0	0	0	7	8	1 AG
8/5	0	0	0	0	0	0	23	3	26	1	0	1	0	0	0	9	7	
8/6	2	0	2	0	0	0	9	7	16	0	0	0	0	0	0	9	14	
8/7	1	0	1	0	0	0	31	15	46	0	0	0	1	0	1	14	19	
8/8	1	0	1	0	0	0	15	15	30	0	0	0	0	0	0	6	4	1 S
8/9	0	0	0	0	0	0	34	6	40	0	0	0	0	0	0	0	0	
8/10	0	0	0	0	0	0	10	7	17	1	0	1	1	0	1	14	19	
8/11	3	0	3	0	0	0	23	13	36	0	0	0	0	0	0	14	18	1;1 S;NP
8/12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8/13	2	0	2	0	0	0	24	4	28	0	0	0	1	0	1	28	8	1 S
8/14	1	0	1	0	0	0	4	2	6	0	0	0	0	0	0	36	3	2 AG
8/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8/16	0	0	0	0	0	0	22	5	27	0	0	0	0	0	0	38	6	2 S
8/17 [b]	0	0	0	0	0	0	12	4	16	0	0	0	0	0	0	63	6	
8/18 [b]	0	0	0	0	0	0	4	2	6	0	0	0	1	0	1	16	3	
8/19 [b]	0	0	0	0	0	0	4	3	7	0	0	0	0	0	0	59	6	
8/20 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8/21 [b]	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	22	0	
8/22 [b]	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	21	3	
8/23 [b]	0	0	0	0	0	0	2	2	4	0	0	0	0	0	0	19	1	
8/24 [b]	0	0	0	0	0	0	4	1	5	0	0	0	0	0	0	10	0	
8/25 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1	1;1 S;NP
8/26 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

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Appendix B.–Page 3 of 3.

Date	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose	White-		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Sucker	fish	Other[a]	
8/27 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/28 [b]	0	0	0	0	0	0	3	0	3	0	0	0	1	0	1	0	0		
8/29 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/30 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/31 [b]	0	0	0	0	0	0	2	2	4	0	0	0	2	2	4	3	0		
9/1 [b]	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	6	5	2	NP
9/2 [b]	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	6	0		
9/3 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	NP
9/4 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/5 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1		
9/6 [b]	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0		
9/7 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1		
9/8 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/9 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/10 [b]	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	3	0		
9/11 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0		
9/12 [b]	0	0	0	0	0	0	0	0	0	0	0	0	2	9	11	5	0	4	NP
9/13 [b]	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	7	3		
9/14 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0		
9/15 [b]	0	0	0	0	0	0	0	0	0	0	0	0	5	1	6	1	0		
9/16 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6	0	1	NP
9/17 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/18 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	15	3	1	NP
9/19 [b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	21	1	NP
9/20 [b]	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	28	26	1;1	S;NP
9/21 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	16	20	2	NP
9/22 [b]	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	17	27	3	NP
Subtotal	10	1		0	0		406	187		3	0		32	15					
Total	11			0			593			3			47			584	273	27	

[a] S = Sheefish; G = Arctic grayling; P = Northern pike

[b] Downstream passage chutes were in place, thereby decreasing the carcass deposition.